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GREENING THE THRIFTY FOOD PLAN – HOW ADDING A SUSTAINABILITY CONSTRAINT AFFECTS PRICE, AVAILABILITY AND MARKET BASKET COMPOSITION

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ABSTRACT

Objective: The objective of this study was to explore the potential impacts of a sustainability constraint on monthly cost, composition and availability of the USDA Thrifty Food Plan (TFP) market basket.

Methods: A sustainability constraint was specified to include a sustainable eating pattern, organic certification, seasonality, regionally or locally produced foods. Three levels of natural resource costs were considered. A store food list of 68 foods (119 items reflecting different food forms) produced in the Northeast region was generated reflecting the TFP. Price and availability data for conventional and organic varieties were recorded at four distinct food retail store types: supercenters, full-service supermarkets and small independent and discount grocery stores. Seasonal and local produce price information was collected at a farmers' market. Food price data were collected and recorded at three time points in five different retail food stores and one time point at the farmers' market in one metropolitan low-income area of Upstate New York.

Analysis: Food price differences were determined between conventional and organic varieties available at five retail food stores. Additional price comparisons were made with local, seasonal produce options available at a regional market. Availability of items found in the sustainable TFP market basket was measured based on the absence or presence at the data points in the five retail food stores. A Tufts University Excel-based TFP calculator was used to adjust the TFP food categories to reflect the sustainable eating pattern and determine cost.

Results: In total, 67 conventional foods (117 items) and 52 organic foods (78 items) were available from the 68-food (119-item) store food list. Availability of organic foods (and items) among the five retail food stores was inconsistent. Data suggest an average 70% premium exists for organic foods. An average discount of 21% was found at a farmers' market for seasonal

produce. The total TFP monthly cost increased by 96%, 93% and 84% under a low, moderate and high sustainable pattern.

Conclusion: The cost of a sustainable TFP substantially exceeded the cost constraint of the TFP. Much of this increase can be attributed to inclusion of certified organic foods. Sustainable eating patterns, seasonality and regional and local foods account for a much smaller proportion of the cost difference. In addition, only a small portion of retail food stores may offer a sufficient variety of organic options as part of a healthy and sustainable diet. This suggests that the sustainable TFP with this sustainability constraint would be challenging for the TFP population in terms of access to sufficient organic food variety and cost.

GREENING THE THRIFTY FOOD PLAN – HOW ADDING A SUSTAINABILITY CONSTRAINT AFFECTS PRICE, AVAILABILITY AND MARKET BASKET COMPOSITION

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Syracuse University 2011

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Syracuse University

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Part 1. LITERATURE REVIEW

Thrifty Food Plan

The Thrifty Food Plan (TFP) is a standard developed by the USDA's Center for Nutrition Policy and Promotion (CNPP) for achieving a nutritious diet with minimal monetary resources.[1,2] The USDA has created food guides since the 19th century, but the TFP's origins date back to the 1930s when the USDA developed four plans for families of different income levels: the (1) Restricted Food Plan for Emergency Use, the (2) Minimum-Cost Food Plan, the (3) Moderate-Cost Food Plan and the (4) Liberal-Cost Food Plan. The two lower cost plans were designed for families most affected by the Great Depression and were replaced in the 1940s with the Low-Cost Food Plan.[2] The Economy Food Plan, created in 1961, was a plan developed for emergency or short-term use and was priced lower than the Low-Cost Plan. The 1964 Food Stamp Program also required that the Economy Food Plan would serve as the basis for the maximum food stamp allotment.[2] This plan was replaced by the TFP in 1975 with a new set of market baskets "based on up-to-date dietary recommendations, food composition data, food habits, and food price information," but with the same minimal cost as the Economy Food Plan.[2]

The 2006 TFP is the most recent plan produced by the CNPP. "The TFP is used by the Federal Government to provide food and economic information to consumers purchasing food on a limited budget" and, most notably, is the basis for the maximum Supplemental Nutrition Assistance Program (SNAP) allotment.[2] The TFP is designed for low-income households, which is defined as at or below 130 percent of the U.S. poverty threshold of before-tax income. This is also the SNAP eligibility limit for gross income.[2]

The TFP provides a meal plan that is designed to be achievable within specific budget constraints. The TFP is the lowest cost meal plan of the four plans developed by the USDA. Data

from the 2001-2002 National Health and Examination Survey (NHANES) and the 2001-2002 Food Price Database were used to develop the TFP's market baskets, which reflect the effect changes in food prices have had on food choices and consumption patterns. These market baskets identify types and quantities of foods that individuals may purchase for a nutritious diet at minimal cost. The TFP was designed for consumption of food at home. In total, there are 15 age-gender specific market baskets consisting of 29 food categories.[2]

Additionally, the food market baskets are subject to certain constraints. The constraints consist of a list of criteria that must be met by the market baskets. The constraints require the baskets to meet the USDA dietary recommendations and not exceed a maximum cost. Specifically, they must meet the 1997-2005 Recommended Dietary Allowances (RDAs), Adequate Intakes (AIs) and Acceptable Macronutrient Distribution Ranges (AMDRs), as well as the 2005 MyPyramid food intake recommendations[i] and 2005 Dietary Guidelines for Americans (DGAs).[2,3] The CNPP constrained the maximum cost of each basket to equal the inflation-adjusted average cost of the 2001-2002 TFP. Therefore, the market baskets can be used as a guide for educational programs and as a reference for improving nutrition policy and budgeting food expenditures of low-income families.[2]

To calculate the market baskets for each age-gender group, a mathematical optimization model was developed which "selected the optimal food plan that met the dietary standards and cost constraints with as little change as possible from reported food consumption."[2] The model had four inputs based on 58 food categories: average consumption for the 15 age-gender groups, cost per 100 grams, nutrient profile per 100 grams, and MyPyramid profile per 100 grams of the

[i] The USDA MyPlate is the current nutrition guide and replaced the 2005 MyPyramid Food Guidance System in 2011. The most recent version of the TFP was published in April 2007, which preceded MyPlate.

food categories. The model was also subject to the three constraints: dietary standards (RDAs, AIs and AMDRs), MyPyramid recommendations and maximum cost allotment for the age-sex groups. The 15 age-gender specific market baskets calculated by this model were organized into MyPyramid daily intake amounts and "as-purchased" forms for 29 food categories. Finally, a 5 percent waste factor was assumed and applied to the market basket.[2]

Food Security

An underlying aim of the TFP is to address food security. Food security is a critical national and global concern. Food secure households are described as having sufficient access and resources to affordable and nutrient diverse foods to enable all members of the household to lead active and healthy lives.[4,5,6] Food insecure households "lack access to adequate food because of limited money or other resources".[7] The prevalence of food insecurity in the United States steadily increased during the recession from 11.1% in 2007 and peaked at 14.9% in 2011.[8] Food insecurity prevalence decreased slightly in the past five years, but is still highly prevalent with the United States Department of Agriculture (USDA) reporting 12.7% of households as food insecure "at least some time" during 2015, or 15.8 million reported households. This was a significant decline from 14% in 2014 or 17.4 million reported households, but still above the pre-recession 11.1% in 2007.[8] Food insecurity has clear socioeconomic and demographic dimensions, with high prevalence primarily among low educated minority populations with children in the household.[1,8]

Food insecurity is a leading public health and nutrition issue in the United States. While food insecurity can result in inadequate energy intake and hunger, low-quality diets rich in low-nutrient, energy-dense foods is a common concern for populations that experience food insecurity.[5,6] Food insecurity is often associated with higher intakes of added sugar and energy-

dense foods, along with lower Healthy Eating Index (HEI) scores and lower intakes of vegetables.[5]

These factors may result in negative health effects as a consequence of food insecurity, hunger and low-quality diets. In addition to low nutrient intake, food security is associated with health issues, including poorer general health (characterized by low self-rating on a health scale), restricted activity and poor functional health measured from the Health Utility Index (HUI), increased mental health problems such as anxiety and depression, and increased incidence of birth defects, diabetes, and hypertension.[1,7,9]

Influence of TFP on USDA Food and Nutrition Assistance Programs

To mitigate food insecurity, the USDA currently has several programs in place to provide food and nutritional support for children and adults, primarily through the Food and Nutrition Service (FNS) agency. The National School Lunch Program (NSLP), SNAP and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) are the three largest programs offered by the USDA's FNS agency.[1,10,11]

The NSLP provides reimbursement and donated USDA commodities for meals served by school districts and independent schools that take part in the program. Participating schools must provide free or reduced priced lunches to eligible children and meet Federal requirements. The School Breakfast Program and Summer Food Service Program provide more nutritious meals to eligible children.[1,10,12] In 2016, an average of 30.3 million children benefited from the NSLP.[10]

The SNAP program provides monthly benefits to eligible low-income households to purchase food. SNAP also offers nutrition education to promote and assist households to make healthy diet and lifestyle choices.[1,10] In 2016, SNAP average monthly participation was 44.2 million people or 14% of the United States population.[10]

WIC is a preventative program to protect the health of low-income, nutritionally at risk pregnant, breastfeeding and nonbreastfeeding women up to 6 months postpartum, infants and children up to age 5 by providing nutritious foods, healthy eating education and health care referrals to improve and maintain health of participants.[10,13] In 2014, WIC assisted an average of 7.7 million individuals per month.[10]

Eligibility requirements for these programs are influenced by the TFP. As previously mentioned, the TFP is the basis for the maximum SNAP allotment. Also, the TFP and SNAP have the same income thresholds of at or below 130 percent of the U.S. poverty threshold of before-tax income.[2,10] SNAP eligibility and participation have direct impact on eligibility in the other food security programs, NSLP and WIC. First, individual eligibility for the NSLP is income based, and the free meal income cutoff is the SNAP income limit.[12] Second, the NSLP has a Community Eligibility Provision, which allows schools with high poverty rates that qualify to provide free meals to all students. Specifically, community eligibility is based on the percentage of households in the school's community that are eligible for or participate in SNAP.[14] Finally, to participate in WIC, applicants must meet a categorical, residential, income and nutritional risk eligibility requirement. Households that are eligible for SNAP automatically meet the income eligibility requirement.[13] In addition, food packages provided by WIC and meals provided by the NSLP were updated to comply with the 2005 DGAs, which is also a TFP nutritional constraint. Currently, no nutritional requirements exist for food purchases through SNAP, but nutrition education for meeting DGAs is provided.[11] Thus, the TFP plays a central role in and has important nutritional guidance connections with the FNS agency's food security assistance policies and programs.

Sustainability

Another consideration related to food security is sustainability. Food system sustainability is a critical and growing national and global concern. Food processing- and production-related environmental impacts stem from land, water and energy use. Loss of biodiversity, deforestation, extensive fresh water use, declining soil fertility, and over-fishing are all negative environmental impacts that have resulted from the use of certain standardized food production practices (i.e. industrial agriculture and monocultural production). These issues, along with other concerns, such as climate change, dietary pattern shifts in populations and population growth, all threaten the long-term food security of national and global populations.[15,16]

One of the primary approaches in mitigating these impacts, is the promotion and practice of sustainable (traditional) agriculture. Sustainable agriculture is a farming system that can sustain "productivity and usefulness to society indefinitely." This is accomplished by the system being "resource-conserving, socially supportive, commercially competitive, and environmentally sound".[16] The 1990 Farm Bill defined sustainable agriculture as "an integrated system of plant and animal production practices having a site-specific application that will over the long-term: satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agriculture economy depends; make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole."[16,17]

The USDA has been active in promoting sustainability. Several programs and resources within the USDA provide information and practices for sustainable agriculture promotion. For example, the Sustainable Agriculture Program in the USDA's National Institute of Food and

Agriculture promote farm and ranch practices, like integrated pest management, rotational grazing, soil conservation, water quality and wetland conservation, cover crops, crop and landscape diversity, nutrient management, agroforestry and alterative marketing. Other sustainable programs in the USDA include the Conservation Reserve Program, Natural Resources Conservation Service, Sustainable Agriculture Research & Education, Farm Service Agency Farm Loan Program and organic certification program, which serve to promote traditional and innovative (e.g. hydroponics) sustainable agriculture practices.[1,10,17]

In addition, several programs exist under the USDA that meet both nutritional and sustainable aims. WIC has two programs promoting farmers' markets: the Farmers' Market Nutrition Program and the Senior Farmers' Market Program. These programs provide support for foods offered at farmers' markets for WIC recipients and low-income seniors.[1,10] SNAP benefits can be used at a growing number of regional and local farmers' markets in the U.S. The Know Your Farmer, Know Your Food (KYF2) project "is a USDA-wide effort to strengthen local and regional food systems." Programs and initiatives under the KYF2 project, include the People's Garden and Farm to School program. The efforts of the People's Garden have resulted in over 2,100 community and school gardens in the US. Lastly, the Farm to School program connects schools and students with local and regionally produced foods.[10,17] Thus, the practice of encouraging sustainability in USDA food security programs is well-established.

Discussion of and evidence on issues of sustainability was included in the USDA's Scientific Report of the 2015 Dietary Guidelines Advisory Committee (DGAC). This report provides the scientific foundation for the 2015 DGAs, which serve as a basis in federal nutrition policy and education.[15,18] The report, for the first time, called for food system sustainability, through sustainable diets, to be explicitly addressed and included in the 2015 DGAs.[15] The

DGAC's definition of sustainable diets modified the Food and Agriculture Organization (FAO) definition[19] for an "operationalized" classification that supported the DGAC efforts. The DGAC defines sustainable diets as "a pattern of eating that promotes health and well-being and provides food security for the present population while sustaining human and natural resources for future generations".[15] The DGAC's inclusion of such language in their report represents an important step in the growing global and national discussion that nutrition policy should consider both the health and sustainability implications of dietary patterns.[15,20] The DGAs, updated every five years, have consistently recommended diets of increased plant-based foods and decreased animal-based foods as the more healthful dietary pattern.[20] The 2015 DGAC has determined that sufficient evidence exists that such dietary patterns are also more environmentally sustainable than the typical Western dietary pattern.[15,20] Thus, the DGAC suggests embracing a food systems approach, instead of a stricter health and nutrition approach, in order to promote and preserve the health of current generations and assure food security of future generations.[15]

This approach would also align with the many existing USDA sustainability programs and research initiatives.[1,10,17] Also, considering that these sustainable programs and all of the nutritional programs discussed (TFP, SNAP, WIC and NSLP) are part of USDA agencies, it provides added strength and relevance to the food system approach recommendation of the DGAC and would promote a more unified approach for the USDA.[15,20]

Sustainable Dietary Guidelines

Globally, several existing and proposed sustainable dietary guidelines (SDGs) provide examples of a food systems approach for sustainable and health-driven recommendations.[21] These SDG are considered to either be existing or proposed dietary guidelines. The existing SDGs (Brazil, Germany, Qatar, Sweden) are official government dietary guidelines. The

proposed SDGs are categorized as discussed ("inclusion of sustainability was discussed"), quasi-official (produced by organizations recognized or accredited by the government, but not within a governmental department and does not represent official policy) or non-official (produced by non-governmental or academic organizations) dietary guidelines.[22]

The guidelines within these SDGs can be organized either as "general sustainable guidelines" or "food group specific sustainable guidelines." General sustainable guidelines are not food group specific. These guidelines address areas of eating behaviors, food sources and production methods that have been found to be sustainable. Food group specific sustainable guidelines consist of recommendations that are specific to a food group. These guidelines address food group pattern quantities, nutrient content, and processing and production methods that have been found to be sustainable.

General Sustainable Guidelines. In total, three general sustainable guidelines could be met by the TFP dietary constraints: overconsumption, food waste and a mainly plant-based dietary patterns. Overconsumption of foods resulting in excess energy intake is a key public health issue, with environmental and health implications.[22,23,24] Given the health implications, this issue is addressed in the health-based MyPyramid and DGAs recommendations for appropriate energy intakes.[18,25,26] Food waste is also addressed through the reduced energy requirements addressing overconsumption.[18,25,26] In addition, the recommendation of increased nutrient-dense and whole foods from MyPyramid and the DGAs satisfies this issue, as fresh foods reduce packing waste.[18,22,23,27] The SDGs emphasize a mainly plant-based dietary pattern.[22,28] MyPyramid and the DGAs recommend increased consumption of nutrient-dense and whole foods, such as fruits, vegetables and whole grains, which are plant-based foods. These foods require minimal processing and do not require the intensive production, processing and

transportation of processed foods. In addition, the 2015 DGAs provided the Healthy U.S.-Style Eating Pattern, which consists primarily of plant foods with an appropriate energy intake level. This pattern is consistent with the 2005 DGAs and MyPyramid recommendations. The only exception is the oils recommendation: the 2005 DGAs recommend a 24g daily intake, and the 2015 DGAs and MyPyramid recommend a 27g daily intake.[18,25,26]

Organic certification provides a discrete sustainable dietary recommendation (not addressed through health- and nutrition-driven recommendations). Yet, the merits of organic production as a sustainable method are still under debate. In some cases, organic production may require more land and produce more greenhouse gas emissions (GHG) than conventional practices.[22,27,29] However, other benefits offered by organic agriculture, including soil fertility improvement, biodiversity maintenance and natural resource (soil, water and air) protection, support its role in sustainability.[18,29,30] In addition, several of the SDGs explicitly recommend organic products.[15,22,31] Further, many consistently reliable labels exist to help consumers chose products produced organically. These labels also address another sustainability indicator, animal welfare, through their standards for certification.[32]

Food Group Specific Sustainable Dietary Guidelines (SDGs). Among the five food groups, three food groups had sustainable guidelines that could be met by the TFP dietary constraints: dairy products, grains and fats, oils & sweets. The main environmental recommendation for dairy product sustainable guidelines is to consume low-fat and unsweetened varieties.[22] The sustainable dietary recommendation for grain is to consume whole grains and limit refined grains.[22] Reduction of calories from processed foods, saturated fat and added sugars is a prevalent health issue that is addressed through the DGAs and MyPyramid recommendations.[18,25,26] These recommendations extend to the fats, oils & sweets food group,

which consists of oils and discretionary calories (saturated fat and added sugars).[18,25,26] MyPyramid and DGA recommendations promote vegetable oils and soft margarines without trans fat as part of a healthy eating pattern due to their unsaturated fat and vitamin E content. These guidelines also recommend limiting solid fats as they contain higher amounts of saturated fat and less vitamin E compared with vegetable oils.[18,25,26] These recommendations are consistent with the those of the existing SDGs.[22]

SDGs for the remaining food groups, fruits, vegetables and meat & beans foods, have guidelines that are distinctly sustainable recommendations. The prevailing environmental recommendations for fruit and vegetable sustainable guidelines is to consume seasonal and regional or local produce.[22,23] Seasonal and regional produce require fewer inputs for production and are generally less expensive. Sweden's SDGs emphasize high fiber vegetables over salad greens for a smaller ecological impact and longer shelf life (less waste).[31,33] The USDA DGAs recommend include vegetable subgroups which consist primarily of high fiber vegetables. Produce source and seasonality, however, is not addressed.[18,25] The German Sustainable Shopping Basket (GSSB) recommends the following "rule of thumb" in selecting produce: When overseas fruits and vegetables are produced by the most sustainable method, the produce will be deemed to have an "acceptable energy balance," if costly storage was not required and produce was transported by ship. Since consumers ordinarily cannot determine transport method, choosing produce that is organic, regional and seasonal is best. However, it may be difficult to find produce items with all three of these characteristics year-round. Therefore, the GSSB rule of thumb recommends that the produce meet at least one of the three characteristics: organic, regional or seasonal.[34] In addition, several consistently reliable produce labels are available to consumers to help chose more sustainable produce options.[32]

The meat & beans food group, has several subgroups with a number of sustainable recommendations. These recommendations address a couple factors including production and processing and source (animal versus plant). Therefore, the central theme around these recommendations is quantity eaten.

Red Meat. Consistent with the guideline for individuals to follow a mainly plant-based diet, SDGs universally recommend reduced meat consumption.[22,23,28] Further, protein overconsumption is a concern in developed countries, and emerging issue in developing countries.[35] The production process for beef inefficient in producing edible calories in relation to production inputs causing negative environmental impacts.[15,22,29,35] Other red meats (pork and lamb) have also been shown to be more harmful to the planet than plant-based protein sources, with lamb requiring the most natural resource inputs after beef.[15,29,35] Recommendations from the existing SDGs have different suggestions for red meat consumption limits. Germany recommends no more than 300-600 grams (11-21 oz.) per week, Sweden limits red and processed meat to no more than 500 (18 oz.) grams per week, Qatar also limits red meat intake to 500 grams per week, but recommends avoiding processed meat, while Brazil gives no specific quantity recommendations, but also advocates avoiding ultra-processed meat.[22] In addition, SDGs recommend that, with decreased intake of red meat, red meat quality should be increased, such as leaner varieties and organically raised options.[31,34,36] MyPyramid and the DGAs recommend that meat choices should be lean and discretionary calories are available for moderate or high fat meat choices. However, a specific red meat intake recommendation is not included, rather a general consumption pattern recommendation for meat, poultry and eggs combined is provided.[18,25,26]

Seafood. Increased seafood intake is recommended by MyPyramid and the DGAs due to its recognized health benefits, as seafood is a good source of unsaturated fats, particularly fatty fish, which contain omega-3 fatty acids (EPA and DHA).[18,25,26] However, the SDGs recognize the sustainable paradox of increasing seafood intakes.[15,22,37] Overfishing and species depletion threatens future sustainability.[15,22,24,28] Increased aquaculture and capture fisheries has helped to mitigate sustainability concerns for marine waters, however, present their own sustainability concerns and lower nutrient profiles compared to wild-caught seafood.[15,24,33]

The DGAC determined that for capture fisheries to "avoid over-exploitation and long-term collapse" careful management is essential. The committee also found that farmed-raised high-trophic seafood species (bass, cod, trout, salmon) have comparable or additional quantities of omega-3 fatty acids as the same wild-caught species. On the other hand, low-trophic seafood species (catfish, crawfish), contain less than half of the omega-3 fatty acid quantities as the same wild-caught species. The projected expansion of aquaculture, when "distributed evenly to the world's population" is estimated to meet the recommendation of at least 8 oz. per week.[15] However, the DGAC cited concern that this expansion would occur in the form of increased low-trophic species rather than high-trophic. The current seafood consumption in the U.S. is far below the recommended intake.[15] The DGAC found that, currently, in order for Americans to meet the recommendations, about 90% of seafood would need to be imported.[15]

The majority of the SDGs recommend choosing seafood from recognized sustainable certifiers, such as Greenpeace, Marine Stewardship Council, World Wide Fund for Nature and Aquaculture Stewardship Council.[22,23,34] Recommended minimum levels of seafood intake varies among SDGs. Germany recommends at least 1-2 servings (4-8 oz.) per week, Sweden sets a minimum of 2-3 servings (8-12 oz.) per week and encourages enjoyment of mussels to "reduce

eutrophication of the seas", Qatar recommends at least two servings per week, while Brazil gives no specific quantity recommendations.[22,36] The MyPyramid recommendations and 2005 DGAs did not have a specific seafood recommendation.[25,26] The 2015 DGAs recommends 8 ounce-equivalents per week.[18] While these guidelines recommend seafood consumption for health benefits, none address sustainability concerns.[18,25,26] Reduction of cardiovascular disease incidence has been linked with one serving per week intake of fatty fish.[29] Lastly, many consistently reliable labels exist to help consumers chose products produced using sustainable methods, which address overfishing and marine ecosystems.[32]

Poultry. As part of the recommendation to reduce red meat consumption, moderate consumption of poultry is encouraged by SDGs.[22] Poultry has a greater environment and climate impact than plant-based foods, but less so than red meat.[22,29] Further, poultry (without skin) is not associated with the health risks associated with red meat as it is a lean meat.[18,31,36] Also, as with red meat, processed versions of poultry, such as chicken nuggets, should be limited or avoided. The SDGs recommend moderate consumption, but do not provide a specific intake minimum or limit for poultry.[22] The DGAs and MyPyramid recommend eating poultry in moderation as part of an eating pattern that includes a variety in the meat, poultry, egg subgroup.[18,25,26] These guidelines recognize poultry as a nutrient-dense food, but do not provide specific poultry intake amounts for the meat, poultry and eggs subgroup.[18,25,26]

Eggs. The recommendations for eggs in existing SDGs is consistent with poultry recommendations.[22,36] The DGAs and MyPyramid recommendations for poultry also apply to eggs. Eggs are also identified as a nutrient-dense food and, similar to poultry, no specific intake level in included.[18,25,26]

Legumes. The existing SDGs recommend increased intake of legumes as part of a mainly plant-based diet. Qatar SDGs recommend legumes to be consumed daily, but no specific quantities are recommended by any of the existing SDGs.[22] Legumes can be a vegetable source or a protein foods source. The DGAs and MyPyramid recommend legumes as a source of protein in a varied protein eating pattern of both plant- and animal-based proteins.[18,25,26] However, legumes quantities have only been specified in the vegetable food group.[18,25]

Nuts, Seeds and Soy Products. Existing SDGs recommend increased consumption of unsalted nuts and seeds as part of a mainly plant-based diet.[22] The DGAs and MyPyramid recommend consuming moderate amounts of nuts and seeds as part of a varied protein source. These guidelines also recognize nuts and seeds as nutrient-dense foods.[18,25,26] Soy products are discussed in the Qatar SDGs as a plant-based protein source.[36] Soy products are not discussed in the other existing SDGs.[31,37,38] Many soy products are processed and should be limited. Whole soy foods, such as tofu and tempeh are more sustainable and support the mainly plant-based eating pattern recommendation. The DGAs and MyPyramid recommend soy products as a plant-based source of protein in a varied protein eating pattern. However, soy product intakes in the nuts, seeds and soy products (NSSP) subgroup have not been specified.[18,25,26]

The evidence and rationale for sustainability to be included in nutritional guidance and follow a food system approach to combat food insecurity is robust. However, little research has been done on the potential cost or feasibility aspects of following a sustainable diet, especially for low-income populations. The TFP is a model to promote food security by providing guidance for a nutritious diet "under minimal costs." Through a sustainability constraint applied to the TFP, this study will explore potential impacts on cost, composition and availability on the USDA TFP market basket.

Part 2: THESIS MANUSCRIPT

INTRODUCTION

The Thrifty Food Plan (TFP) is a standard developed by the USDA's Center for Nutrition Policy and Promotion (CNPP) agency used to promote food security.[2] It is used by the Federal government to provide food and economic information for consumers on a limited budget.[2] The TFP does this by providing specific types and quantities of food for a nutritious diet at a minimal cost.[2] Also, the TFP serves as the basis for the maximum SNAP allotment.[2] This is an important aspect because SNAP eligibility and participation have direct impacts on other food and nutrition assistance programs.

The TFP, a USDA program, applies the USDA 2005 DGAs as a nutrition constraint.[2] The DGAs are also used to improve SNAP, WIC and NSLP food and nutrition. The guidelines are the basis for SNAP nutrition and health education.[2,39] Also, food packages and school lunches from WIC and NSLP, respectively, must be consistent with the DGAs.**Error! Bookmark not defined.**

SNAP, NSLP and WIC are the three largest programs of the USDA Food and Nutrition Service agency. SNAP influences eligibility of NSLP and WIC. First, if a person is eligible for SNAP, then they automatically meet the income requirement for WIC.[13] Second, the SNAP income eligibility limit is the income cut-off for children to receive free meals from the NSLP.[12] Further, in the NSLP Community Eligibility Provision, if a certain percentage of households within a school district are eligible for or participate in SNAP, all students can receive free meals.[14] Thus, the TFP has important ties to the major food and nutrition assistance programs, through SNAP.

In 2015, the Dietary Guidelines Advisory Committee (DGAC) produced its scientific report (another product of the USDA) with recommendations for the 2015 DGAs. This report

drew attention because of Chapter 5 – Sustainability and Food Safety.[15] In this chapter, the committee determined that substantial evidence shows that long-term food security is threatened by sustainability concerns, climate change, dietary pattern shifts in populations, and population growth.[15] The committee, for the first time, called for food system sustainability to be included in the 2015 DGAs, making recommendations based on health and sustainable needs.[15] Chapter 5 is the latest contribution to a body of global sustainable dietary guidelines (SDGs). These SDGs either address the sustainable impact of the health-based guidelines or provide individual sustainable recommendations. Many of the SDGs were also addressed by the TFP nutrition constraints (MyPyramid and DGAs).[15,18] So, even though this recommendation by the committee was ultimately rejected in the 2015 DGAs, it's fair to say it produced a lot of attention and the recommendation was highly supported by robust evidence. In addition, numerous programs and initiatives within the USDA aim to promote a sustainable food system. Some of these programs already have health and sustainability aims, aligning with a food system approach.[17] Therefore, sustainability in dietary guidance may be a reality at some point in the future.

The DGAC food security definition states that "food security exists when all people now, and in the future, have access to sufficient, safe, and nutritious food to maintain a healthy and active life."[15] So, including sustainability in programs aimed at promoting food security within the USDA would seem logical.

Considering all this information, along with the DGAC's definition of food security, the argument can be made for a sustainability constraint in the TFP that would also promote a more unified approach for the USDA. Therefore, the purpose of this study was to investigate the impact a sustainability constraint might have on monthly cost and market basket composition when applied to the TFP. In addition, the availability of the market basket will also be

researched, an area that has not been explored by the TFP. The study focuses on sustainability in the context of New York (NY) state.

METHODS

Study Design

A cross-sectional descriptive study design was employed for this study in which prices and availability of components of two distinct market baskets were compared.

Sustainability Constraint

Sustainability recommendations from existing and proposed SDGs, that were distinct from established TFP nutrition constraints, were used to form a sustainability constraint. To address the complexity of incorporating certain key recommendations critical to a sustainable diet, such as eating seasonal produce, NY state was used as a context.[21,22]

For this study, the following criteria were considered to develop the sustainability constraint: method of production (specifically organically produced or not), seasonality and source (local or regional of specific foods), and diet composition (food group and subgroup proportionality). The resulting sustainable TFP market basket included foods that were produced organically and produce that was from local sources, and varied in terms of the proportion of animal derived versus plant-based foods. Seasonality and locally produced food sustainable criteria were applied to the fruits and vegetables group only.

The Healthy U.S.-Style Eating Pattern (2,000 kcal) from the 2015 DGAs provided the basis for the sustainable TFP market basket. To translate sustainable dietary recommendations into market basket quantities in the meat & beans food group, the following limits were imposed. For seafood, a maximum intake of one serving per week (4 ounce-equivalents per week (oz-

eq/wk)) was used.[29] A maximum intake level of 12 oz-eq/wk (350 grams) was used for red meat. Both poultry and eggs had an intake level of at least 2 servings per week (8 oz-eq/wk and 2 oz-eq/wk, respectively). Processed red meat and poultry were avoided. A minimum intake of 3 oz-eq/wk was used for legumes as a source of protein in the meat & beans food group (legume intake levels as a vegetable source are shown in Table 1). A total intake of 8 oz-eq/wk was used for nuts, seeds and soy products (NSSP), with 4 oz-eq/wk for nuts and seeds and 4 oz-eq/wk for soy products. Intake levels for all food groups were applied to the Healthy U.S.-Style Eating Pattern.

Levels of Sustainability. The Healthy U.S.-Style Eating Pattern and the adjusted sustainable Healthy U.S.-Style Eating Pattern, both allow flexibility in food subgroup consumption in the meat & beans foods, fruits (whole and juice) and grains (whole and refined) food groups.

To examine how eating pattern variations within recommendations may impact cost and the TFP market basket composition, low, moderate and high sustainability levels were created. The low sustainability level consists of the minimum or maximum intake limits for whole fruit, fruit juice, whole grains, refined grains and red meat subgroups. The moderate sustainability level increases whole fruit and whole grain subgroup intake by 25% (reducing fruit juice and refined grains subgroups by 25%) and reduces red meat subgroup intake by 3 oz-eq. The high sustainability level consists intake of the whole fruits and whole grains subgroups, avoiding fruit juice and refined grains subgroups, and cuts red meat subgroup intake in half to 6 oz-eq.

The low, moderate and high sustainability Healthy U.S.-Style Eating Pattern (2,000 calorie level) is shown in Table 1. This eating pattern was applied to the 15 age-gender specific market baskets in the TFP.

Table 1. 2015 Dietary Guidelines for Americans (DGA) Healthy U.S.-Style Eating Pattern (2,000 kcal), original and adjusted based on low, moderate and high sustainability patterns.

FOOD GROUP	DAILY AMOUNT			
	2015 DGA	Levels of Sustainability		
		Low	Moderate	High
Vegetables	**2.5 c-eq**			
Dark-green vegetables (c-eq/wk)	1.5	1.5	1.5	1.5
Red & orange vegetables (c-eq/wk)	5.5	5.5	5.5	5.5
Legumes (beans and peas) (c-eq/wk)	1.5	2.25 [2]	2.75 [3]	3.25 [4]
Starchy vegetables (c-eq/wk)	5	5	5	5
Other vegetables (c-eq/wk)	4	4	4	4
Fruits	**2 c-eq**			
Whole fruit (c-eq/day)	NS [1]	1 (50%)	1.5 (75%)	2 (100%)
Fruit juice (c-eq/day)	NS [1]	1 (50%)	0.5 (25%)	0 (0%)
Grains	**6 oz-eq**			
Whole grains (oz-eq/day)	≥ 3	3 (50%)	4.5 (75%)	6 (100%)
Refined grains (oz-eq/day)	≤ 3	3 (50%)	1.5 (25%)	0 (0%)
Dairy Products	**3 c-eq**			
Meat & Beans	**5.5 oz-eq**			
Seafood (oz-eq/wk)	8	4	4	4
Meats, poultry, eggs (oz-eq/wk)	26	12 (red meat)	9 (red meat)	6 (red meat)
		9 (poultry)	9 (poultry)	8 (poultry)
		3 (eggs)	3.5 (eggs)	2 (eggs)
Nuts, seeds, soy products (oz-eq/wk)	5	7.5	9	11
Oils	**27 g**			
Limit on Calories for Other Uses	**270 (14%)**			

[1] Not specified

[2] Low sustainability pattern level include 1½ cups per week of legumes as a vegetable subgroup, and an additional 3 oz-eq (¾ cups) per week of legumes as a protein food. The total amount is shown here as legumes in the vegetable group.

[3] Moderate sustainability pattern level include 1½ cups per week of legumes as a vegetable subgroup, and an additional 5 oz-eq (1¼ cups) per week of legumes as a protein food. The total amount is shown here as legumes in the vegetable group.

[4] Low sustainability pattern level include 1½ cups per week of legumes as a vegetable subgroup, and an additional 7.5 oz-eq (1¾ cups) per week of legumes as a protein food. The total amount is shown here as legumes in the vegetable group.

Market Basket

From the adjusted healthy U.S.-style eating pattern a store food list of 68 foods, consisting of 119 food items which reflect the various forms (i.e. frozen, canned, fresh), was generated to reflect the TFP and incorporate the sustainability constraint (Table 1). Availability and prices for each item were recorded directly on the food list. Five stores were selected to represent the range of food retail types in the study area: supercenters (n=1), supermarkets (n=2, supermarket 1 and supermarket 2), small independent grocery stores (n=1) and discount grocery stores (n=1). The stores selected had to meet the following inclusion criteria: the store must be one of the five retail types previously listed; must be located within the city boundaries; and accept WIC and SNAP benefits. The stores selected were located on the west side of the city, a low-income area, and were either accessible through public transportation or could be easily accessed by foot. Availability, price and quantity information was recorded at three time points at each store for each food item over a 6-week period in December 2016 and January 2017. Data collection for each time point was completed on the same day of the week. Friday was chosen as the data collection day as it is the start of the busiest shopping period of the week (Friday through Sunday).[40] It was reasonably expected that during the progression of the weekend, items might become less available.

Data collection procedures were developed for price and product information selection. A pilot test for the survey and procedures was performed at a supermarket not included for data

collection. Adjustments were subsequently made to create the finalized procedures and list for data collection. The procedures tested and finalized are described below.

Store brands, which are typically priced lower than manufacturer brand products, were prioritized. If a store brand was not available for a food item, the price of the lowest priced manufacturer brand was recorded. In the original procedures, only retail price information was to be collected. During the pilot test, store "club" discount prices were identified. These prices could easily be accessible with a free store membership. Therefore, when present, store "club" discount price was recorded. Bulk items were the preferred choice over packaged. Quantities from bulk items can be customized and meet the criteria for reduced food waste. For the original procedures, the lowest unit price of a food item was to be recorded, regardless of packaging size. Family size items are sold at a lower price per unit measure than a regular sized item. Further, during the pilot test, organic family size products were found to be not common. Therefore, family sized items were excluded from the finalized procedures to avoid skewing price differences between conventional and organic price data.

The most commonly consumed and representative food items for each food group and subgroup were included on the food list.[41,42,43,44,45] With a few exceptions (i.e. peanuts, almonds and canola oil) all items on the list are produced in NY or in the Northeastern states.[46,47,48,49] For seafood items, sustainable options were identified by third party designations found on labels, such as Marine Stewardship Council or the Monterey Bay Aquarium Seafood Watch.[32,50] If a seafood option was determined to be at least a "Best Choice" or "Good Alternative"[50], it was included as a sustainable option. If insufficient information was available to determine if the seafood option was sustainable, it was categorized as a conventional option. Canned fruit was included on the list only if packed in water or 100% fruit juice to avoid added sugars and ultra-

processed foods (syrup). Frozen potatoes were included only in the whole form – fried forms of potatoes were not included, consistent with dietary and sustainable guidelines.

Data Collection

To assess availability, organic premium/discounts and farmers' market produce premium/discounts, price and availability data were collected at five retail food markets in a medium-sized city in Upstate NY and one nearby regional farmers' market. The farmers' market was used as the reference for seasonal and local produce prices.[51]

Farmers' Market Price Collection. A food list of produce and price information at a farmers' market was collected to determine the average price premium or discount of produce in season and from local sources. The largest farmers' market in the city was selected, as it would offer the most vendors and accepted SNAP benefits. The market was also accessible through public transportation (bus). These data were collected at a single time point in mid-October. The growing and availability season for many produce varieties had ended or would soon be ending at this point in the year. Therefore, availability of several produce items, particularly fruit might be limited.[48]

All fruits or vegetables available at the farmers' market were recorded to create the farmers' market food list, with each unique price and quantity pairing (e.g. 1 quart apples for $3, 2 quarts apples for $3, 1 quart of apples for $3.50). The broad produce type was recorded, not specific varieties (i.e. apples, not Pink Lady and McIntosh apples), apart from dark-green lettuce (e.g. bok choy, kale), tomatoes (e.g. grape, roma) and squash (e.g. spaghetti, delicata).

The farmers' price data was compared with conventional store price data. Supermarket 1 was used for comparison to determine the farmers' market price premium or discount. This store information was collected on the same day as the farmers' market visit.

Data Analysis

Tools. The Thrifty Food Plan Calculator, a tool developed by the Food Policy and Applied Nutrition program at Tufts University, was used to determine the new composition of the sustainable TFP market baskets. This calculator was freely available online. The Tufts TFP calculator was developed to learn "about the tradeoffs between the nutrition quality and costs of foods available in the United States." [52] The Excel-based calculator was designed "based on the same price, consumption and nutrition data that USDA used to create the official 2006 food plan."[52] The calculator has the original 58 TFP food categories. These categories were adjusted until they were consistent with the sustainable healthy U.S.-style eating pattern for each sustainability level. Essentially, the amounts of the whole food categories were adjusted up and were the primary categories of the market basket. On the other hand, primarily processed food categories were adjusted down to no or very minimal amounts. The calculator then determined cost and dietary quality details based on this new plan.

The other criterion of the sustainability constraint – organic certification, seasonality, and regional and local foods – could not be measured or analyzed by the TFP calculator. These components relate to specific production methods. They can be measured by cost and their impact on market basket composition by their availability. The information from the two lists (store and farmers' market) were used for these measurements.

Availability. Using the data collected from the store food list, an availability of conventional and organic foods and items were determined. The presence or absence of conventional and organic food items and forms on the food list were used to determine total, store and food group average availability of options in the conventional and organic market

baskets. Availability of seasonal and local produce was determined from the fruits and vegetables that were available at the farmers' market (farmers' market food list).

Organic and Farmers' Market Premium/Discounts. Quantities were recorded in ounces or fluid ounces (i.e. pound, quart, etc.) for price and quantity information to a unit price of dollars per ounce. The average premium or discount for each organic food item and farmers' market produce item was calculated and an average premium or discount was determined for each food group, using the following formula:

Premium/Discount(%) = [New Price($) – Benchmark Price($)]/Benchmark Price($)

For the organic premium/discount, the conventional food item unit price was the Benchmark Price($) and organic food item unit price was used for the New Price($). For the farmers' market seasonal premium/discount, Supermarket 1 produce item unit price was the Benchmark Price($) and the farmers' market produce item unit price was the New Price($).

Modifying TFP to Meet Sustainability Constraint. Three approaches were applied to adjust the TFP to meet the sustainability constraint: 1. Organic certification for regional foods; 2. Sustainable healthy U.S.-style eating pattern; and, 3. Seasonally available local produce items. First, the 58 food categories in the TFP calculator[52] were adjusted, altering the market basket quantities to reflect the sustainable healthy U.S.-style eating pattern (Table 1). Next, the organic premium/discount and farmers' markets premium/discount for each applicable food group were applied to their respective spending levels to yield the sustainable TFP.

The sustainable TFP was analyzed for comparison with the 2006 TFP (most recent updated version) based on several factors, including: cost and market basket composition. Reported

consumption, included in the 2006 TFP, was also included for further market basket composition analysis comparison.[2]

RESULTS

Availability

Availability was measured by the presence or absence of conventional and organically certified foods (and items) from a 119-item regional food list for 68 foods. The availability of conventional foods (67:68) and items (117:119) was greater overall than their organic counterparts (52:68 foods; 78:119 items) as shown in Table 2. Thus, the full conventional regional market basket was available (99% of foods; 98% of items). Only a partial organic regional market basket was available (75% of foods; 66% of items).

Organic food availability by store, in descending order was as follows: supermarket 1 (50:68), supercenter (29:68), supermarket 2 (27:68), discount grocery store (21:68) and small independent grocery store (1:68). This order also applies to the availability of organic food items. Only one organic regional market basket item was found in the small independent grocery store and the conventional regional market basket was partially available (82% of foods; 71% of items).

The availability of the 119 food items from the regional food list by food group and subgroup for conventional and organic varieties is shown in Table 3. Tempeh and frozen white potatoes were not available in conventional varieties. The proportion of organic item availability by food group and in descending order was as follows: grains (6:7 or 86%), fruits (13:16 or 81%), vegetables (21:31 or 68%), meat & beans (32:51 or 63%), fats, oils & sweets (1:2 or 50%) and dairy products (5:12 or 42%).

Grains. Two stores carried all but one of the organic items listed: supermarket 1 (6:7) and supermarket 2 (4:7). The supercenter (3:7) and discount grocery store (2:7) had less than half of the organic items listed. Organic whole wheat/grain tortillas/wraps were not available in any of the stores.

The discount grocery store and supermarket 1 had all conventional items listed. Farro was the only food that was not available at supermarket 2, supercenter and small independent grocery store.

Fruits. Supermarket 1 had over three quarters (13:16) of the organic items listed. The discount grocery store, supermarket 2 and supercenter had less than half of the organic items listed. These stores had between 5 and 7 items available. Organic watermelons were not available in any of the stores.

The supercenter had all conventional items in the list. The discount grocery store, supermarket 1 and supermarket 2 had between 14 and 16 conventional items. The small independent grocery store had 10 conventional items.

Vegetables. Supermarket 1 carried nearly two thirds (19:31) of the organic items listed. The discount grocery store, supermarket 2 and supercenter had less than half of the organic items listed. Organic lima beans, in any form, were not available in any stores. All forms of organic romaine lettuce, broccoli, sweet potatoes, lentils, green peas, yellow onions, iceberg lettuce and cabbage were available. Thus, at least one food, in all forms, was available for each vegetable subgroup.

Supermarket 1, supermarket 2, supercenter and small independent grocery store had between 27 and 29 conventional items available. The discount grocery store had 21 conventional items available.

Meat & Beans. Organic item availability of the meat & beans subgroups, in descending order was as follows: eggs (1:1 or 100%), nuts, seeds and soy products (NSSP) (6:7 or 86%), seafood (9:11 or 82%), poultry (11:20 or 55%) and red meat (5:12 or 42%).

Nuts Seeds Soy Products (NSSP). Supermarket 1 had 6 of the 7 organic items listed. The remaining stores had either no items or only one item available in an organic variety. Organic peanuts were not available in any stores. Organic tofu was the only organic food available at the small independent grocery store.

Supermarket 1 also had 6 of 7 conventional items in the list. The remaining stores had between 4 and 5 conventional items available.

Seafood. Supermarket 1 had over half (6:11) of the organic items listed. The discount grocery store, supermarket 2 and supercenter had less than half of the organic items listed. Either 4 or 5 items were available at these stores.

The availability of conventional seafood items varied among the stores. Both supermarkets had 10 items available, the supercenter had 7 items available, the small independent grocery store had 5 items available and the discount grocery store had 3 items available.

Poultry. Supermarket 1 was the only store that had over half (11:20) of organic items listed. The discount grocery store, supermarket 2 and supercenter each had 2 organic items available. Organic half chicken, turkey thighs and whole turkeys were not available in any stores.

The small independent grocery store had the least conventional items available (12:20). The remaining stores had between 14 and 16 conventional items available.

Red Meat. Supermarket 1 had the most organic items (5:12) available of the stores, but less than half of items listed. The remaining stores had either no items or only one item available

in an organic variety. Organic eye of round roast, pork roast and pork chops were not available in any stores.

Both supermarkets and the supercenter had between 9 and 10 conventional items available. The discount grocery store and small independent grocery store had the least number of conventional items available (7:12).

Fats, Oils & Sweets. Organic canola oil was available in the discount grocery store and supermarket 1 only. Organic vegetable oil was not available. Both canola and vegetable oil were available in all stores in conventional varieties.

Dairy Products. As described above, only 5 total items of organic dairy products were available of the 12 items in the list. Therefore, all stores had less than half of the organic items listed. The number of organic items available at the discount grocery store, supermarket 1 and 2 and supercenter ranged between 2 and 4 items.

Supermarket 2 and supercenter had all conventional items listed. The remaining stores had between 9 and 10 conventional items available.

Market Basket Prices

Average conventional unit prices ranged between $0.04 and $0.83, and average organic unit prices ranged between $0.05 and $1.17 for the combined five stores, as shown in Table 4. In total, 51 items were available in organic and conventional varieties. The greatest average price difference between a conventional and organic item was $0.77. The smallest average price difference was $0.00. The conventional average unit price for 43 of the 51 items was less than the organic. The organic average unit price for 6 of the 51 items was less than the conventional. Thus, 2 items had the same average unit price for conventional and organic varieties.

At the discount grocery store, a total of 18 items (1 dairy product item, 5 meat & beans items, 2 grains items, 5 fruits items, 4 vegetables items and 1 fats, oils & sweets item) were available in both conventional and organic varieties. Conventional and organic meat & beans and fruits had the largest range in prices as shown in Figure 1. Grains had the smallest price range for conventional and organic varieties. For median price differences, the same food groups with the largest and smallest price ranges from above, had the largest and smallest price differences. The median price differences in descending order between conventional and organic varieties in each food group were as follows: $0.14 for meats & beans, $0.12 for fruits, $0.06 for vegetables and $0.04 for grains. Price distribution was not measured for dairy products and fats, oils & sweets as only one form was available in both conventional and organic varieties.

At supermarket 1, a total of 69 forms (4 dairy product forms, 28 meat & beans forms, 6 grains forms, 12 fruits forms, 18 vegetables forms and 1 fats, oils & sweets form) were available in both conventional and organic varieties. Conventional and organic meat & beans and fruits had the largest distribution range in prices as shown in Figure 2. Dairy products had the smallest price distribution range for conventional and organic varieties. For median price differences, the same food groups with the largest and smallest price ranges from above, had the largest and smallest price differences. The median price differences in descending order between conventional and organic varieties in each food group were as follows: $0.20 for meats & beans, $0.16 for fruits, $0.10 for grains and vegetables and $0.03 for dairy products. Price distribution was not measured for fats, oils & sweets as only one form was available in both conventional and organic varieties.

At supermarket 2, a total of 32 forms (4 dairy product forms, 6 meat & beans forms, 4 grains forms, 6 fruits forms, 12 vegetables forms and 0 fats, oils & sweets form) were available

in both conventional and organic varieties. Conventional and organic dairy products and meat & beans had the largest distribution range in prices as shown in Figure 3. Grains had the smallest price distribution range for conventional and organic varieties. For median price differences, the same food groups with the largest and smallest price ranges from above, were not the largest and smallest price differences. The median price differences in descending order between conventional and organic varieties in each food group were as follows: $0.33 for meats & beans, $0.07 for grains and fruits, $0.03 for vegetables and $0.01 for dairy products. The different findings between the price range and median price is due to an outlier in the dairy products food group. Supermarket 2 was the only store that had organic cheddar cheese available with a unit price of $0.62, which was much higher than the other unit prices in this group (between $0.06 and $0.13). The organic cheddar cheese unit price substantially increased the organic unit price range (additional $0.49). Price distribution was not measured for fats, oils & sweets as no organic varieties were available.

At the supercenter, a total of 36 forms (3 dairy product forms, 9 meat & beans forms, 3 grains forms, 7 fruits forms, 14 vegetables forms and 0 fats, oils & sweets form) were available in both conventional and organic varieties. Conventional and organic meat & beans had the largest distribution range in prices as shown in Figure 4. Dairy products and grains had the smallest price distribution range for conventional and organic varieties. For median price differences, the same food groups with the largest and smallest price ranges from above, had the largest and smallest price differences. The median price differences in descending order between conventional and organic varieties in each food group were as follows: $0.17 for meats & beans, $0.10 for fruits, $0.06 for vegetables, $0.04 for grains and $0.02 for dairy products. Price distribution was not measured for fats, oils & sweets as no organic varieties were available.

Organic Premium/Discount. In the initial premium/discount calculations for the organic items, all food groups and subgroups had a price premium. Premiums for organic food groups were: 64% for dairy products, 92% for meat & beans, 66% for grains, 62% for fruits, 93% for vegetables and 437% for fats, oils & sweets. These food group premiums averaged a premium of 136% for all organic foods.

Given the limited number of items for the fats, oils & sweets food group, the low availability of organic options and the extremely high premium (437%), this food group premium was determined to be an outlier. Therefore, the calculated premium for the fats, oils & sweets group was removed, which decreased the total premium to 75% for organic foods. A premium or discount is needed for each food group to calculate the cost of the sustainable TFP. Organic butter and olive oil premium/discount information was collected by a Consumer Report study from eight food retailers.[53] The premiums/discounts for these items were averaged to determine a fats, oils & sweets premium of 42%. This premium was applied and the total average organic premium was calculated as 70%. Table 5 shows the total, food group, and subgroup premiums, initially, after removal of the fats, oils & sweets group premium (437%) outlier, and after application of the Consumer Report average fats, oils & sweets group premium (42%).

Farmers' Market Premium/Discount. At the data point for the farmers' market, 21 produce items were available: 3 fruit items and 18 vegetable items. All vegetable subgroups were available at the farmers' market. There were 2 dark-green items, 5 red & orange items, 2 starchy items, and 9 other vegetable items.

Table 6 details discounts found at the farmers' market on selected produce items. The average unit prices for the fruit and vegetable food group items were all available at a discount

compared to supermarket 1 (retail food store) unit prices. The total produce discount was 21%, with a 22% discount for fruits and 20% discount for vegetables.

Monthly Sustainable TFP Cost

Analysis of monthly sustainable TFP cost and market basket composition was completed for all 15 age-gender specific market basket. For this study, the USDA TFP reference family was used for analysis. The USDA TFP reference family consists of a male and female adult ages 20-50 and two children ages 6-8 and 9-11.

The total average monthly cost of the sustainable TFP increased from the USDA TFP as presented in Table 7. First, the sustainable healthy U.S.-style eating pattern was applied which increased cost by 21%, 19% and 14% for the low, moderate and high sustainability level from the USDA TFP. Then, the organic premium (higher prices) and farmers' market discount (lower prices) were applied which increased cost by a total of 96%, 93% and 84% for the low, moderate and high sustainability level from the USDA TFP.

In Table 8, the cost of the dairy products, meat & beans, grains, fruits and vegetables food groups increased the cost of the sustainable TFP in comparison to the TFP. The cost increase in descending order by food group for low, moderate and high sustainability levels were as follows, in descending order: meat & beans (153%, 129%, 104%), grains (110%, 128%, 118%), dairy products (112%, 112%, 114%), and vegetables (74%, 80%, 81%) and fruits (57%, 50%, 39%).

The fats, oils & sweets food group decreased the cost of the sustainable TFP compared with the TFP. The cost of the fats, oils & sweets food group decreased by 42%, 38% and 41% for the low, moderate and high sustainability level from the USDA TFP.

Nutrition Composition

Nutrition information for the sustainable TFP market basket are presented in Table 9. In comparison to the TFP market basket, the sustainable TFP market basket has a lower proportion of fat (28.0%, 28.8%, 29.0% of kcals), linoleic acid (6.1%, 6.5%, 6.7% of kcals) and linolenic acid (0.61%, 0.61%, 0.60% of kcals) to total calories. The sustainable TFP market basket has a higher proportion of saturated fat (9.1%, 9.3%, 9.1% of kcals), carbohydrates (55.6%, 55.5%, 56.2% of kcals) and protein (18.3%, 17.9%, 17.2% of kcals) to total calories than the USDA TFP market basket.

At the micronutrient level, the sustainable TFP market basket has lower sodium levels (2570 mg, 2526 mg, 2462 mg) than the USDA TFP market basket for all sustainability levels. At a low sustainability level, the sustainable TFP also has lower fiber levels (29.1 g) than the TFP market basket. At a high sustainability level, the sustainable TFP has lower folate (511 mg), vitamin B_{12} (5.9 mg) and iron (15 mg) levels than the TFP market basket. The sustainable TFP market basket has higher calcium (1412 mg, 1401 mg, 1347 mg), vitamin A (1597 mg, 1622 mg, 1518 mg), vitamin C (167 mg, 154 mg, 135 mg), vitamin B_6 (3.0 mg, 3.0 mg, 2.8 mg), potassium (4309 mg, 4303 mg, 4292 mg), cholesterol (296 mg, 313 mg, 247 mg) and added sugars (346 g, 349 g, 339 g) levels than the TFP market basket. At a low sustainability level, the sustainable TFP market basket has higher folate (790 mg), vitamin B_{12} (7.7 mg) and iron (21 mg) levels than the TFP market basket. At a moderate sustainability level, the sustainable TFP market basket has higher fiber (33.1 g), folate (712 mg), vitamin B_{12} (7.3 mg) and iron (20 mg) levels than the TFP market basket. Lastly, at a high sustainability level, the sustainable TFP market basket has higher fiber (37.2 g) levels than the USDA TFP market basket.

In comparison with recommendations, the sustainable TFP market basket was within recommended distribution ranges for all macronutrients. For micronutrients, the sustainable TFP market basket has higher calcium, folate, vitamin A, vitamin C, vitamin B_6, vitamin B_{12}, iron, sodium and added sugar levels than recommendations. At a moderate sustainability level, the sustainable TFP market basket has higher fiber and cholesterol levels than recommendations. At a high sustainability level, the sustainable TFP has higher fiber levels than recommendations. The sustainable TFP market basket has lower potassium levels than recommendations for all sustainability levels. At a low sustainability level, the sustainable TFP market basket has lower fiber and cholesterol levels than recommendations. Lastly, at a high sustainability level, the sustainable TFP market basket has lower cholesterol levels than recommended limits.

DISCUSSION

This study sought to explore the potential impacts of a sustainability constraint on the monthly food costs for low-income consumers and on market basket composition and food availability. The sustainability constraint consisted of a sustainable healthy U.S.-style eating pattern, organic certification, seasonality, and regionally or locally produced foods. To measure effects different levels of sustainable eating might have on cost and market basket composition, low, moderate and high sustainability patterns were developed. Using NY state as the contex for this study, a regional food list was created for data collection at five retail food stores. The purpose of the store food list was to record food price and availability information to determine an average premium or discount and availability for organic food items in each food group. Seasonal and local produce availability and price information was collected at an area farmers' market.

Overall, the conventional regional market basket was available (67:68 foods and 117:119 items) and the organic regional market basket was partially available (52:68 foods and 78:119 items) among the five retail food stores. Also, the organic food and item availability was inconsistent among the stores. The organic regional market basket had a 70% average premium over the conventional regional market basket. Seasonal produce at the farmers' market had an average discount of 21%. For the sustainable TFP, the cost of the low, moderate and high sustainability pattern was 96%, 93% and 84% higher than the USDA TFP.

Organic and conventional regional market baskets differed in availability by food, item and food group. Organic regional market basket foods were less available on average than conventional regional market basket foods. For the conventional regional market basket, all foods and items were available except 1 food and 2 items. The regional market basket can be achieved exclusively from conventional varieties. However, the organic certification criteria of the sustainability constraint cannot be fully met for the regional market basket. Therefore, a regional market basket with organic foods must be supplemented with conventional varieties to achieve a full regional market basket.

The fats, oils & sweets and dairy product groups were ranked as the least available food groups for the organic regional market basket. The low availability of dairy products can be attributed to a couple factors. First, dietary and sustainable guidelines recommend consumption of primarily low-fat (1%) and fat-free dairy products.[18,22,25] However, only full fat or reduced fat (2%) options of organic canned (evaporated) milk, cottage cheese, sour cream, and, in some cases, yogurt were available. So, the information for these items was not collected. Second, organic dry milk and cheese were not available in the stores, except for cheddar cheese, which was only available at supermarket 2. These results suggest meeting the criteria for both the

sustainability and nutrition constraints for the dairy products food group will depend on the limited number of organic items available in this category. Organic items with higher availability included fresh milk (available in 4 stores), soy milk (available in 4 stores) and Greek yogurt (available in 3 stores). Low-income populations interested in sustainability may adhere to an organic certification constraint for these specific items though not to dairy products as a whole.

The high availability of conventional varieties of vegetable and canola oil was expected. Organic canola oil was available in 2 stores (discount grocery store and supermarket 2) and organic vegetable oil was not available in any stores. Vegetable oil is primarily derived from soy beans, which account for approximately 90% of U.S. oilseed production.[54] In addition, soy milk and tofu, also derived from soy beans, were two of the most available organic food items (available in 4 stores). So, it is somewhat surprising that organic vegetable oil was not available at all. One possible explanation, is that despite a substantial growth in crop acreage for many organic food items, growth for certain key crops (e.g. corn, soybeans and wheat) was much slower, despite the potential for much higher returns than conventional crops.[55] Potential explanations for this slow growth include the ease of acquiring conventional seeds and chemicals, regional variation of pest levels, lack of a regional market for organic crops (food or feed), and lack of knowledge about the cost and returns that can be achieved from organic crops.[55] Organic plant-based oils were available in stores and perhaps a wider variety of options should have been included on the food list to obtain a more accurate reflection of availability and cost for these oils. On the other hand, vegetable oil ingredients consist of more than just soy bean oil. Therefore, all the oils, which come from various sources, within vegetable oil would need to be organically certified. This may be challenging and potentially not cost effective. This could be another possible explanation for a lack of organic vegetable oil.

Vegetables and fruits were the second and third most available organic food groups. This is a positive finding in meeting the sustainability constraint of the sustainable TFP. Organic watermelons were not available and only some organic peach options were available in supermarket 1 only, which pushed down the average organic availability of fruits. Organic dark-green vegetables were more commonly available, increasing total vegetable availability. Organic legumes had a low availability which diminished total availability of vegetables. An important component of nutritional and sustainable recommendations is to consume a variety of fruit and vegetable types.[18,19,36,37] The fruit and vegetable food list strived to represent the variety available within these groups that are regional to NY. While availability of organic watermelons, peaches and legumes was limited, conventional versions of these food items were readily available. In general, fruits and vegetables use much less land and rainwater, and produce less greenhouse gas (GHG) emissions per calorie than animal-based foods.[35] So, there may be only a marginal increase in land, water use and GHG emissions if a few conventional varieties are consumed with primarily organic fruit and vegetable varieties.

Temporal considerations are important in availability for many fresh foods, especially produce. Local and seasonal produce item availability at one farmers' market was more representative of vegetables grown in NY than fruits. Only three fruits were available at the farmers' market, representing only 27% of fruits shown on the NY harvest calendar. On the other hand, 18 vegetables were available, representing 75% of vegetables shown on the harvest calendar.[49] This information was collected in mid-October at the end of the growing season in NY.[49] Therefore, the discount determined for fruits is likely to be more inaccurate than for vegetables.

Data collected from both stores and the farmers' market were conducted at points in the year when fresh items are typically less available. Apples were the only fresh fruit on the store food list (17% of fresh fruits on list) that was seasonally available in NY (9% of fruits from NY harvest calendar)[49] at the time of the store data points. On the other hand, five fresh vegetables (broccoli, cabbage, carrots, onions and potatoes) from the store food list (36% of fresh vegetables on list) were seasonally available in NY (21% of vegetables from NY harvest calendar)[49] at the time of the store data points. Therefore, availability results found in this study, especially for fresh fruit, may be conservative.

For the meat & beans subgroups (seafood, red meat, poultry, eggs, NSSP), over half of the forms listed were available in the seafood, poultry, eggs and NSSP groups. Less than half of listed forms were available for the red meat group. The availability of these meat & beans subgroups indicates organic food access that would align with the aim of promoting a mainly plant-based eating pattern and limiting meat consumption to achieve a sustainable diet. However, sufficient access to organic meats, especially red meat, is important in achieving a sustainable diet. The amount of feed energy and protein used for meat production is highly inefficient in producing edible calories and protein.[35] Also, red meat production requires substantially more land and freshwater, and produces considerably more GHG emissions in comparison with plant-based protein foods.[29,35] Yet, organic meat production could provide some important environment benefits (e.g. bio-diversity, soil conservation, no chemical pesticides for feed grain production) over conventional methods (i.e. concentrated animal feeding operations).[29,35,56] Kumm investigated the sustainability of organic meat production in comparison to conventional methods. Measurement of sustainability was based on land area requirements, bio-diversity and

pesticide use, energy and GHGs, nitrogen and production cost. The study found that organic beef and lamb, but not pork production was more sustainable than their conventional counterparts.[56]

Another temporal consideration relates to cultural and societal seasonality – the major example being holidays. In this study, data was collected from stores during the primary holiday season, so, for example, in the meat & beans group, fresh and frozen turkeys, crab legs, pork loins and various beef roasts were available and featured within stores. If the data had been collected a few months later, there may have been a lack of whole turkeys available, and salmon and ham varieties might have been more highly available and featured.

The Cattlemen's Beef Board & National Cattlemen's Beef Association determined that 51% of total beef sold in the summer was ground beef.[57] The top selling cuts of beef during summer holidays (Memorial Day, Father's Day, Fourth of July and Labor Day) were five steak cuts (ribeye, strip, top sirloin, T-bone, porterhouse) and brisket. Strip and ribeye steaks were the top two cuts for these holidays. Brisket sales are consistently higher than top sirloin, T-bone and porterhouse steak cuts for all summer holidays, except Father's Day. Sirloin steak was determined to be the least affected by seasonal variation. For pork, demand for some cuts, primarily from hogs, are also higher during the summer grilling season (lowest in November and December) and holiday ham demand is the highest in November and December (lowest in June through August).[58] This suggests that seasonal variation in demand for animal-based foods (i.e. meat) is, at least in part, culturally determined. Given the scope of the current study, this aspect could not be explored. The data collection period of this study was too short to examine differences in availability among seasons. Further, only the most commonly consumed meats (available year-round) were included in the food list. However, this is an important concept for

sustainable eating patterns and additional research is needed to examine the yearly seasonal availability and cost impact of various meat cuts.

Among the stores, availability of organic foods was highest at supermarket 1 (50 foods, 72 items available) - far surpassing availability at the other stores (1-29 foods, 1-38 items available). This result was anticipated since supermarket 1 is viewed as a unique leader in quality and variety in the supermarket industry, with a history of commitment to sustainability.[59,60] This could be a distinctive sustainability factor for NY, since 46 (49%) of the 93 store locations for the company are within NY.[61] Conversely, the only organic food found at the small independent grocery store was tofu. The other three stores (discount grocery, supermarket 2 and supercenter) were relatively consistent with between 20-30 organic foods (24-38 items) available on the list. This suggests that the availability of organic foods found in these three stores may represent the more typical organic food item availability in NY retail stores (excluding NYC), while supermarket 1 and small independent grocery store represent an organic market leader and a retail format without an organic market, respectively, in the organic retail availability spectrum.

At the food group level, inconsistencies in organic food group availability was found among the stores. Supermarket 1 had at least half of the items listed for the grains, fruits, vegetables, meat & beans and fats, oils & sweets groups. For the dairy products group, 33% of items (4:12) were available at supermarket 1. Based on these findings, it could reasonably be expected that supermarket 1 would potentially have sufficient variety of organic foods to meet the sustainable TFP market baskets. However, an extensive variety of organic foods seems to be lacking for the dairy products group, animal-based meat & beans subgroups (seafood, red meat and poultry) and most vegetable subgroups (red & orange, legumes, starchy, other). Therefore,

the regional market basket for the sustainable TFP would be limited or would need to be supplemented with conventional varieties.

Among the discount grocery store, supermarket 2 and supercenter, the number of items available for the dairy products, meat & beans, grains, fruits and fats, oils & sweets groups were relatively similar. The number of items available for these stores was more variable for the vegetables food group. Dark-green, red & orange and legume subgroups had a consistent number of items available for the discount grocery store, supermarket 2 and supercenter. The number of starchy and other subgroup items available varied among these stores. The consistency of the dairy products, meat & beans, grains fruits and fats, oils & sweets availability show that the discount grocery store, supermarket 2 and supercenter would each provide relatively equal access of variety for these food groups. However, greater variety and availability of fruit and vegetables were found in supermarket 2 and supercenter than in the discount grocery store. Taking all results for the these stores into consideration, it is likely that none of these stores on their own would provide sufficient variety to meet the sustainable TFP market baskets.

Overall, these findings suggest that sufficient varieties of organic foods are present in the retail food store landscape to meet sustainable consumption patterns of a sustainable TFP. However, to achieve this variety, a consumer may have to purchase organic foods from more than one store, with the possible exception of supermarket 1. Due to this implication, a more narrowed focus, based on food groups and sustainable impact, may be prudent in creating efficient market baskets that best meet organic availability, sustainability and cost constraints. The sustainable impact of purchasing organic versions of certain food groups or subgroups may not justify the increased cost or additional effort to purchase these items because of limited availability.

Very little research exists describing the availability of organic food variety found in retail stores. Limited availability of organic foods in small independent grocery stores is consistent with other findings. In a study conducted in Manhattan, NY, Dimitri & Mirsch examined organic food availability, as a proxy to determine availability of sustainable food.[62] In the first phase of the study, approximately 1,300 stores were located and identified. A wide variety of retail types were found, but there was a higher proportion of small independent grocery stores. A list of organic foods was developed which contained foods from the fruits, vegetables, meat & beans, and dairy products food groups.[62] No items from the grains and fats, oils & sweets groups were included. Availability for most of the items ranged between 0% and 11% of stores. Eggs, packaged lettuce, milk and yogurt were available in between 22% and 35% of stores.[62]

The USDA has found that the sale and demand of organic food products has been steadily increasing, especially after the establishment of the organic national standards. Sales were estimated to represent over 4% of total at-home food sales and yearly double-digit growth was experienced.[63,64,65] Organic food sales between food categories has also expanded.[65] These sale trends indicate that organic availability should grow with the growing demand and sales. The USDA reports that organic foods are available in "nearly 3 out of 4 conventional grocery store," consistent with the above findings.[65] Therefore, purchasing organic foods from the sustainable TFP market baskets should become more achievable in the future.

The sustainable TFP results primarily indicate a moderate cost increase (+14-21%) in the TFP when a sustainable healthy U.S.-style eating pattern is applied by placing a stronger focus on whole foods, an increased avoidance of processed or prepared foods, and red meat and seafood intake is limited. However, the cost of the sustainable TFP increases substantially when

organic certification is also applied (+84-96%), despite a discount for seasonal produce. These results suggest that broad application of organic certification in the sustainable TFP may not be reasonable since it is expensive and may not be attainable for low-income populations. Further, an additional increase in plant-based protein intake and decrease in processed (reduced refined grains and fruit juice) food intake may help moderate the sustainable TFP cost.

In an Australian study, a healthy and sustainable (H&S) basket was developed and compared to a typical basket to investigate cost and affordability (development of the baskets is described later).[51] Price was recorded in five neighborhoods across household income quintiles. The average cost of the H&S basket was more than the typical basket in all five neighborhoods.[51] The most disadvantaged neighborhood had the largest cost difference of 30% between the baskets.[51] For the lowest income quintile households, the typical basket would require between 33% and 44% of weekly income and the H&S basket would require between 40% and 48% of weekly income.[51] Whereas, households at the highest income quintile would require between 6% and 8% of weekly income for the typical basket and between 8% and 9% of weekly income for the H&S basket.[51] The full H&S basket was not found in all of the food outlets visited. Among the food outlets, supermarkets were less expensive than smaller grocery stores and convenience stores. Alternative outlets (i.e. farmers' markets) were also found to be the least expensive food outlet.[51]

In the current study, in the discount grocery store, supermarket 1, supermarket 2 and supercenter, the meat & beans food group had the greatest price range. The meat & beans group also had the second largest organic premium of 92%, which can primarily be attributed to the red meat (124%), poultry (121%) and egg (161%) organic premiums. Red meat and poultry also had the lowest availability among the meat & beans subgroups. This suggests that purchasing organic

red meat and poultry may be very difficult for the TFP target population. However, as previously discussed, conventional meat production has been shown to be highly unsustainable and organic meat production offers sustainable benefits.[29,35,56] Also, plant-based foods from the meat & beans group require far less land, water and produce fewer GHG emissions than the animal-based foods.[29,35] Therefore, given the cost constraints of the TFP population, purchasing organic varieties of animal-based foods could be considered a higher priority than organic varieties of plant-based foods from the meat & beans food groups to achieve the higher sustainable benefit. In addition, the vegetables food group had the largest organic premium of 93%. So, prioritizing organic purchases for animal-based foods over plant-based foods, in general, may reduce the total cost of the sustainable TFP. This study used a combination of organic certification along with seasonal and local produce in the sustainable TFP market basket. Organic certification resulted in a premium for both fruits and vegetables. Seasonal and local produce from a farmers' market resulted in a discount for both produce food groups. A sustainable TFP market basket that includes only seasonal and local produce may be a different approach that could yield a sustainable TFP cost that is achievable for the USDA TFP target population.

Recent USDA data also found that price premiums for animal-based organic foods were higher in comparison to plant-based foods.[66] Overall, the organic premiums ranged between 7% and 82%, which is a lower premium range than the food group premiums in this study (between 42% and 93%).[66] However, the USDA data was determined from 17 food items, including spinach, baby food (junior and strained), granola, soup, coffee, celery, spaghetti sauce and salad, which were not examined in this study. Nielson Homescan data were used to determine these premiums and the data collected was on a national scale.[66] Therefore, the USDA premiums may be the most accurate for the items that were also on the food list in this study (carrots, potatoes,

apples, bread, canned beans, milk, eggs, yogurt). This suggests that it is possible that the premiums determined in the current study may be overstated. In addition, the USDA determined that over a 6-year period, four of the premiums increased, four decreased and for the remaining nine, a pattern was not able to be determined. Thus, no specific trends or patterns could be identified for premiums.[66]

Jaenicke and Carlson measured organic price premiums for four items using a hedonic pricing model and 7 years of Nielson Homescan household data.[67] Canned soup, coffee, milk and bagged carrots were the items selected for analysis. These items were chosen based on their composition variety (soup is highly processed, coffee is imported, milk is an animal-based product, and bagged carrots are minimally processed) and varied organic price premiums.[67] This study determined that organic canned soup premiums are steadily increasing reaching 45% at the end of the 7-year period and coffee prices have been steadily decreasing to approximately 50% by the end of the study period. On the other hand, milk experienced large fluctuations during the period with an average premium of 70% and bagged carrots had smaller fluctuations and an average 30% price premium.[67] At the retail-level, growing organic markets in supercenters were found to reduce organic price premiums. Also, for the organic market, as a whole, there was a direct relationship between market size and price premiums. However, the nonorganic market size had an indirect relationship with organic price premiums.[67] Overall, Janeicke and Carlson concluded that organic price premiums would not be disappearing in the near future, however, there is potential for reduced premiums.[67] These results most likely produced more reliable organic premium information than this study, due to the extended data collection period and use of national data. However, this study used a much more extensive list of foods, which could potentially highlight the possible premium fluctuations between different foods and food groups.

As previously described, the low sustainable TFP market basket had a higher cost premium than the high sustainable TFP market basket, an unexpected result. As expected, the vegetables food group premium did increase from the low sustainable TFP market basket to the high sustainable TFP market basket, but only by 7%. This cost premium increase from the low to high sustainable TFP market basket is also offset by the grains food group – the high sustainable TFP market basket premium was 8% more than the low sustainable TFP market basket. However, in the meat & beans group, the premium decreased by 49% between these two sustainable pattern levels. Within the meat & beans groups, red meat was reduced and plant-based protein foods (legumes and NSSPs) were increased to replace red meat as the sustainability level was increased from low to high. In this change of sustainability level, the red meat cost decreased and the corresponding increase in plant-based protein foods had a smaller cost increase. Essentially, red meat is more expensive per serving and nutrients provided than legumes. Another contributor to this unexpected result may be found in the fruits group. The fruits food group premium decreased from the low sustainable TFP market basket to the high sustainable TFP market basket by 18%. This can be attributed to the decrease in fruit juice cost, which did not correspond with an equal, but smaller increase in whole fruit cost. Essentially, fruit juice is more expensive per serving and nutrients provided than whole fruit varieties.

The grains and fats, oils & sweets food groups increased in cost from the low to moderate sustainability patterns, then decreased from the moderate to high sustainability patterns. The variation in trend (lower cost with increasing sustainable pattern) for the grains group, can be attributed to the composition of the non-whole (refined) grain and whole grain TFP food categories and cost of these categories. Non-whole grain categories consist of products with less than 50 percent of ounce equivalents from whole grains. Thus, whole grain categories consist of

products "with 50 percent or more of ounce equivalents from whole grains."[2] Therefore, increasing whole grain categories may not increase whole grain servings sufficiently. Also, the non-whole grain categories are larger sources of grains than the whole grain categories.[52] Thus, more whole grains were required to replace the grain servings that were reduced by the decreased intake of non-whole grain categories in the moderate sustainability pattern. In addition, whole grain categories have a higher cost per 100 grams than the non-whole grain categories.[52] The cost of the high sustainability pattern was moderated by allocating grain servings primarily to the food categories (i.e. breads, rice and pasta) with the highest grain to whole grain ratio. Finally, the variation in the fats, oils & sweets group can be attributed to insufficient energy (kcal) intake for the moderate sustainability pattern for the adult male and child, age 9-11. Therefore, food categories that are high sources of energy such as fats, oils & sweets, were increased to meet energy needs.[52] The low and high sustainability pattern did not have issues in meeting energy needs and the fats, oils & sweets did not need to be increased.

Finally, when evaluating the monthly cost of the TFP among the age-gender groups of the reference family, the primary finding was that as total energy intake increased, the cost of the sustainable TFP increased. This is an expected result and is consistent with the cost pattern of the original TFP.

Overall, the sustainable TFP market basket nutrition was not comparable with levels in the USDA TFP, but most nutrients met recommended intake levels. Nutrients of concern[68] in the market basket were potassium and sodium, which did not meet recommendations for any of the sustainability pattern levels. The USDA TFP also had this issue, along with not meeting intake levels for vitamin E. Vitamin E daily intake levels were not calculated by the Tufts University TFP calculator, so a comparison was not possible.[52] Added sugar (low, moderate, high

sustainability pattern levels) and cholesterol (moderate sustainability pattern level) exceeded recommended limits in the sustainable TFP market baskets. Added sugar levels over recommended intake levels was also an issue with the USDA TFP. Approximately 100g of the added sugars within the TFP calculator can be attributed to the milk and cheese food categories. However, added sugar is usually only found in flavored milk and not typically found in cheese. Dairy products contain lactose, a naturally occurring sugar and is most likely the 100g that was incorrectly categorized as added sugar for these food categories. Therefore, the added sugar calculated for the sustainable TFP market baskets is possibly overstated and most added sugar levels are probably within recommendations. In the 2015 DGAs, the recommended 300 mg daily intake limit for cholesterol was removed and eating as little dietary cholesterol as possible as part of a healthy eating pattern is advised.[18] Also, the moderate sustainability level cholesterol intake was only 313 mg, which does not substantially exceed the old 300 mg intake limit. Therefore, the cholesterol level for the moderate sustainable TFP is not a concern.

In the current study, sustainability was defined by a sustainable healthy U.S.-style eating pattern (mainly plant-based, whole foods, limit on processed foods, red meat and seafood), organic certification, regional market basket and seasonal and locally produced foods. The regional market basket was created by developing a food list that was used in retail food stores for data collection. Farmers' market produce served as proxies for seasonal and locally produced foods.

The previously described Australian study, which compared cost and affordability of a typical and H&S basket, followed a prior study which developed the principles for the H&S basket.[51,69] The typical basket reflected an average Australian diet. Evidence from publically available academic, government, industry and non-government sources were used to inform

sustainability of the H&S basket.[69] GHG emissions, water use and biodiversity were the sustainability factors measured for the H&S basket. [69] The three guiding principles applied for the H&S basket development aimed to prevent overconsumption, limit energy-dense and processed foods, and decrease animal-based foods, while increasing plant-based foods.[69] These guiding principles are very consistent with the components of the sustainable healthy U.S.-style eating pattern used in this study. The resulting H&S basket consisted of 48 foods, which is slightly comparable to the number of items included on the list in this study.[69]

In a Dutch study, an optimization model through linear programming was used to create an affordable shopping basket that is nutritionally adequate with a low climate impact.[70] The nutritional constraint consisted of meeting 33 nutrient intake levels.[70] GHG emissions were used to measure climate impact and cost was constrained at €2.50 per day.[70] This differed from the current study, which focused on sustainable production methods and sourcing. The upper GHG threshold for the shopping basket was 1.6 kg CO_2eq/day, which represented a 50 percent GHG emission of the average Dutch diet.[70] The cost constraint for the Dutch study is more than a 50 percent reduction in cost from the average Dutch diet. The food products for the shopping basket were chosen based on actual consumption.[70] Based on these factors, the optimization model determined a 63-item shopping basket which met the nutritional constraints.[70] The climate impact of the diet was 1.59 kg CO_2eq/day and the cost was €2.59 per day.[70] The results of this study suggest that with more complex calculations aimed at optimization, it may be possible for the sustainable TFP cost to be reduced to a cost level that is similar to the USDA TFP.

Organic certification was chosen to be included in the sustainability constraint because many agricultural and production practices considered to be sustainable are addressed in some degree through organic certification. In addition, organic certification requires meeting national

standards, providing consistency in production among products since no consensus definition exists for sustainable farms. Also, organic certification is easily identifiable for consumers through a label on product packaging.

In the United Kingdom (UK), a new labelling system has been developed to promote sustainability – carbon footprint labels. This label is part of an initiative to reduce GHG emissions for the UK and requires certification.[71] However, Gadema Z and Oglethorpe D found that, while consumers have an interest in making sustainable food purchases, they lack understanding and knowledge in how to choose products based on carbon footprint labels.[71] Therefore, this label seems to lack the functionality for consumers that is provided from the organic certification label. However, this study shows that consumers have a desire to make sustainable purchases. Also, labels for different sustainability factors (beyond organic certification) is actively being explored so consumers can identify sustainable food options. If this trend continues, it could provide more sustainable options for the sustainable TFP market basket in addition to organic certification.

The current study focused on the environmentally-driven aspects of sustainability. Another aspect of sustainability is socially-driven. The major certification program for this approach to sustainability is Fair Trade. The goal of fair trade is to achieve a more balanced relationship in North-South trading relationships as they relationships have inherent inequities.[72] Successful implementation of fair trade results in increased revenues for producers, workers and community, equal authority for all members and improved working conditions.[72] However, current issues exist in achieving successful implementation. Corporate cooptation has diluted and hindered regulatory standards and advancement and the resulting national standards are weakened.[73] This issue is also a concern for organic certification. Therefore, the sustainability of

organically certified foods is not fully realized due to dilution of regulator standards. Since the current study focused on regional and local foods, Fair Trade would not have been applicable under this criterion (Fair Trade products would not be regional or local). However, social and food justice dimensions of sustainability are critical for addressing food insecurity. Additional research is needed to explore the complexity of eating regional and local foods in conjunction with sustainable practices on a global scale (i.e. Fair Trade).

Organic agriculture and production offers many benefits, but there are several caveats that should be taken into consideration. Organic agriculture has been shown to improve biodiversity and reduce nitrogen losses. However, other concerns such as higher levels of nitrogen leaching into the soil and nitrous oxide (GHG) emissions per product unit were found in comparison with conventional agriculture.[74] Also, organic production has also been shown to require high land use with lower crop yields than in conventional farming.[74] Lastly, certified organic ruminants must have access to pasture land for grazing.[75] Studies have found that pasture-raised ruminants are associated with more GHG emissions.[76,77] However, organic carbon sequestration in soil can help to reduce GHG emissions of pasture raise livestock.[77,78] Finally, organic certification may be too costly for producers following organic practices. These producers offer products that were cultivated through organic and/or sustainable practices. Organizations like the Northeast Organic Farming Association (NOFA) offer pledge commitments as a lower cost alternative to organic certification.[79] However, NOFA certified products are not typically found in food stores, but are readily identifiable for farmers' market shoppers.

Seasonal and local foods were measured through a farmers' market, but other sustainable practices and sources exist for seasonal and local foods that were not measured in this study.

Examples of some of these practices and sources include preserving techniques (i.e. canning, freezing) to extend seasonal foods (fruits, vegetables, seafood), home or community gardens, community supported agriculture (CSAs) and direct consumer-producer relationships (i.e. purchasing meat directly from livestock farmer).

Strengths and Limitations

This study was conducted in NY which is a deciduous region with a humid climate and a history of diverse agriculture. Therefore, a comprehensive food list could be developed representing a wide range of foods from each food group.

Findings are not generalizable since the study was conducted at five stores (1 discount grocery store, 2 supermarkets, 1 supercenter, 1 small independent grocery store) in one city, which is not representative of all retail food stores (in terms of quantity and variety) and there is also a lack of evidence on organic food availability for comparison. Farmers' market data was collected at one time point and does not consider potential price fluctuations that may exist throughout the season. In addition, data was collected in late fall (farmers' market) and early winter, which are not key growing and harvest periods in NY agriculture.

Lastly, the Tufts TFP calculator was also a limitation of this study. This tool has not been fully tested and is an Excel-based tool. The USDA TFP was developed using a complex optimization algorithm and the Excel-based tool produced more simplified calculations. Thus, there is a limitation in how comparable the calculated results will be to the USDA TFP.

Implications for Research

Further research is needed to explore TFP cost and availability by examining variations within these constraints and investigate impacts of other sustainable practices (i.e. CSAs, Fair Trade, community gardens). For instance, future research is needed to determine availability of

both organic food items on a larger scale to examine and assess availability variations across each of the four seasons. In addition, studies should be done exploring possible fluctuations in conventional and organic food items over the course of a year.

CONCLUSION

The cost of a sustainable TFP substantially exceeded the cost constraint of the USDA TFP. Much of this increase can be attributed to organically certified foods. Sustainable patterns, regardless of sustainability pattern level, seasonality and regional and local food items had a smaller impact on cost. In addition, only a small portion of retail food stores may offer a sufficient variety of organic options as part of a healthy and sustainable diet. This suggests that following a sustainable TFP under these defined constraints may be challenging in terms of access and cost for its target population. The results of this study imply that organic certification, as a criteria for the sustainability constraint, may need to be more narrowly defined to food groups or items that offer the best sustainable effects in relation to the associated premium (possibly meat & beans). However, a sustainable eating pattern, seasonality and purchase of regional and seasonal food items may be more attainable approaches to sustainability for the low-income populations than organic certification.

FIGURES AND TABLES

Figure 1. Box plot representation of food group average unit prices (dollars per ounce) of organic and conventional items for a discount grocery store

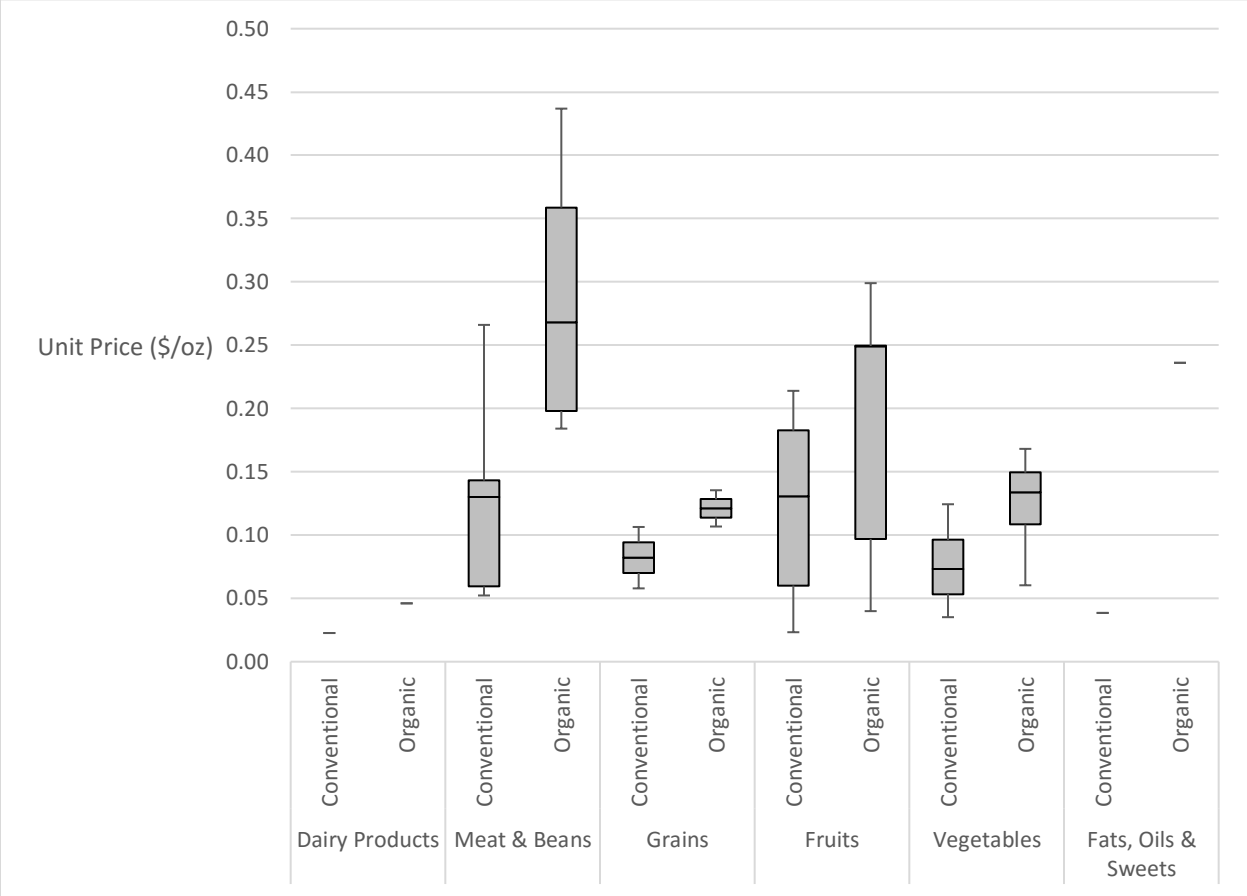

Figure 2. Box plot representation of food group average unit price (dollars per ounce) of organic and conventional items for supermarket 1

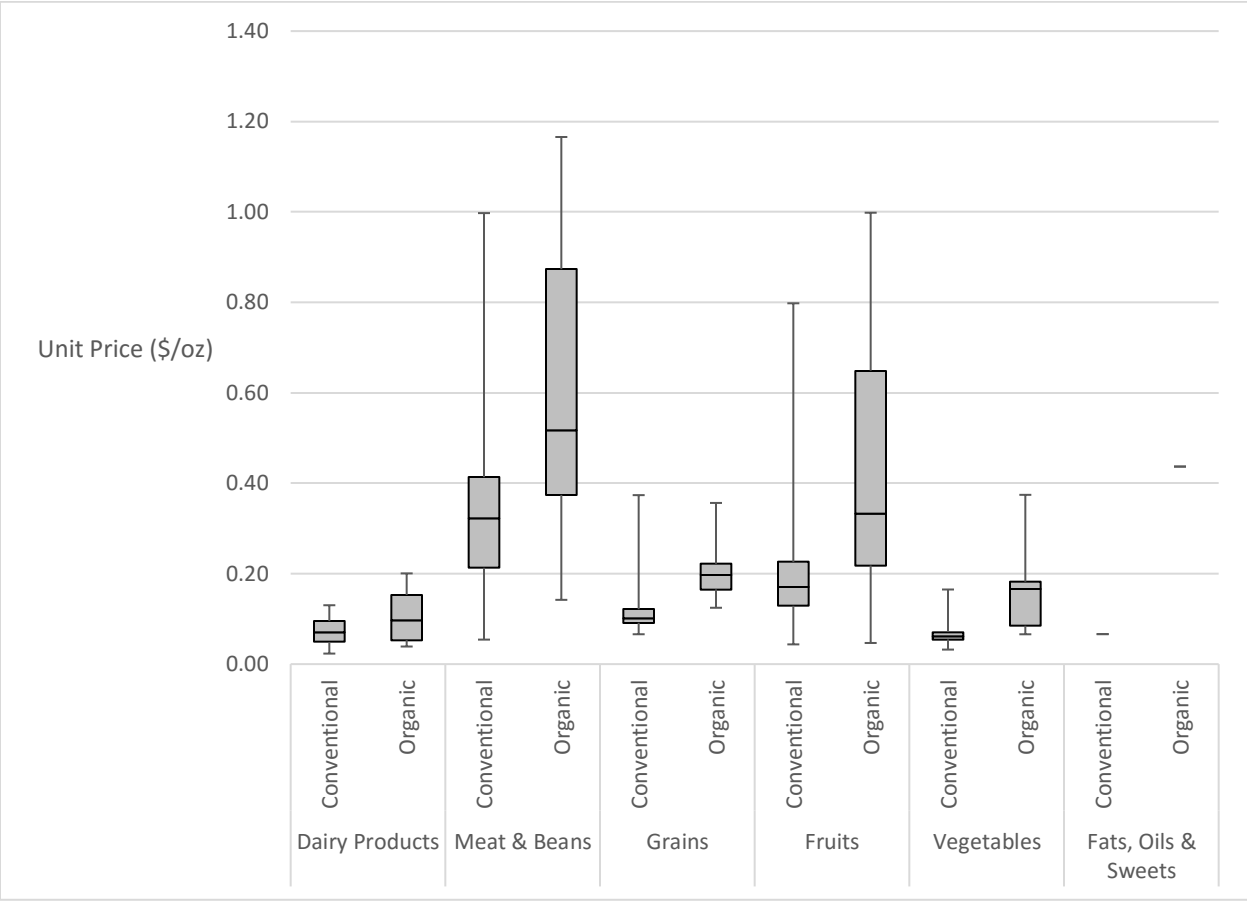

Figure 3. Box plot representation of food group average unit price (dollars per ounce) of organic and conventional items for supermarket 2

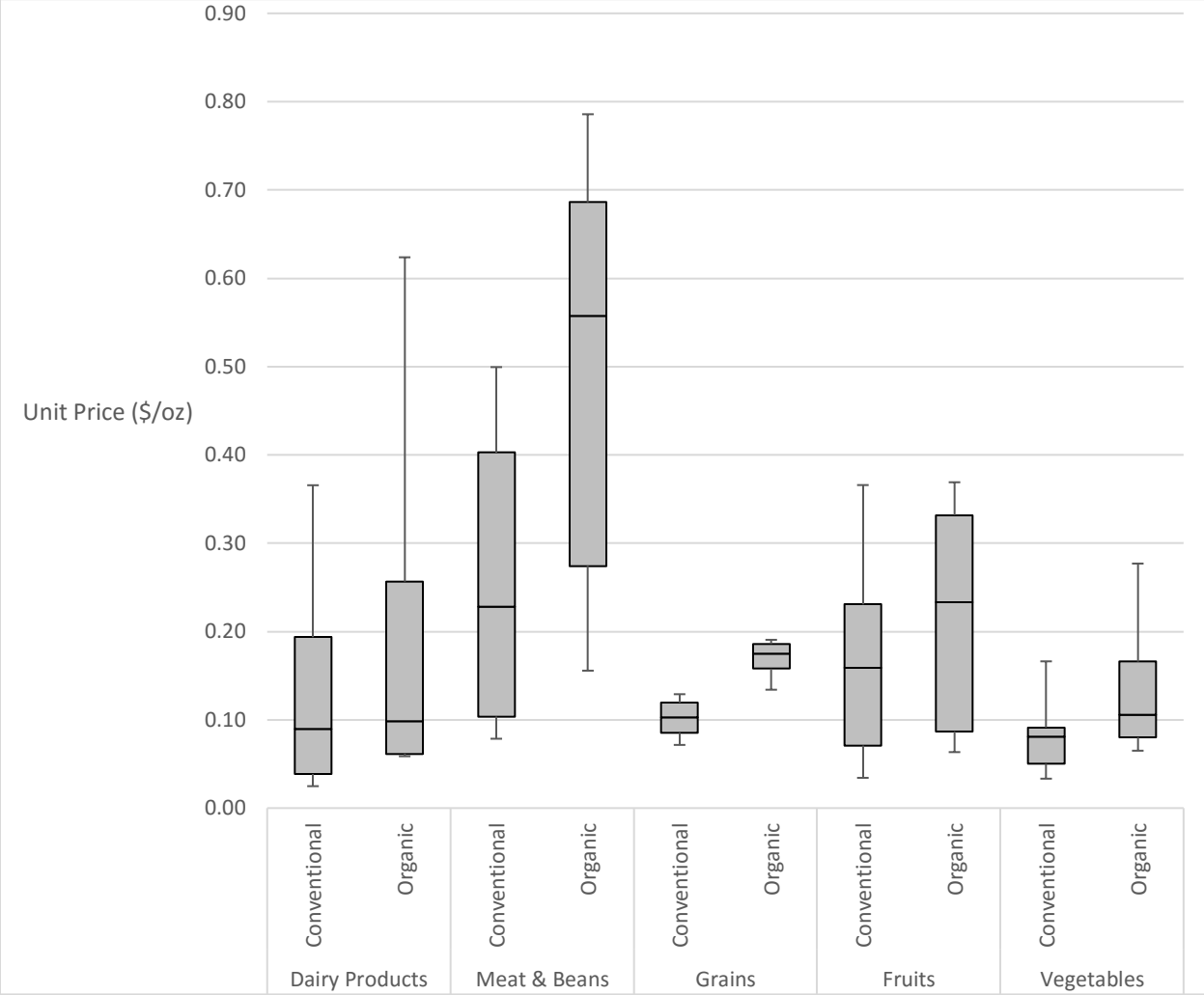

Figure 4. Box plot representation of food group average unit price (dollars per ounce) of organic and conventional items for a supercenter

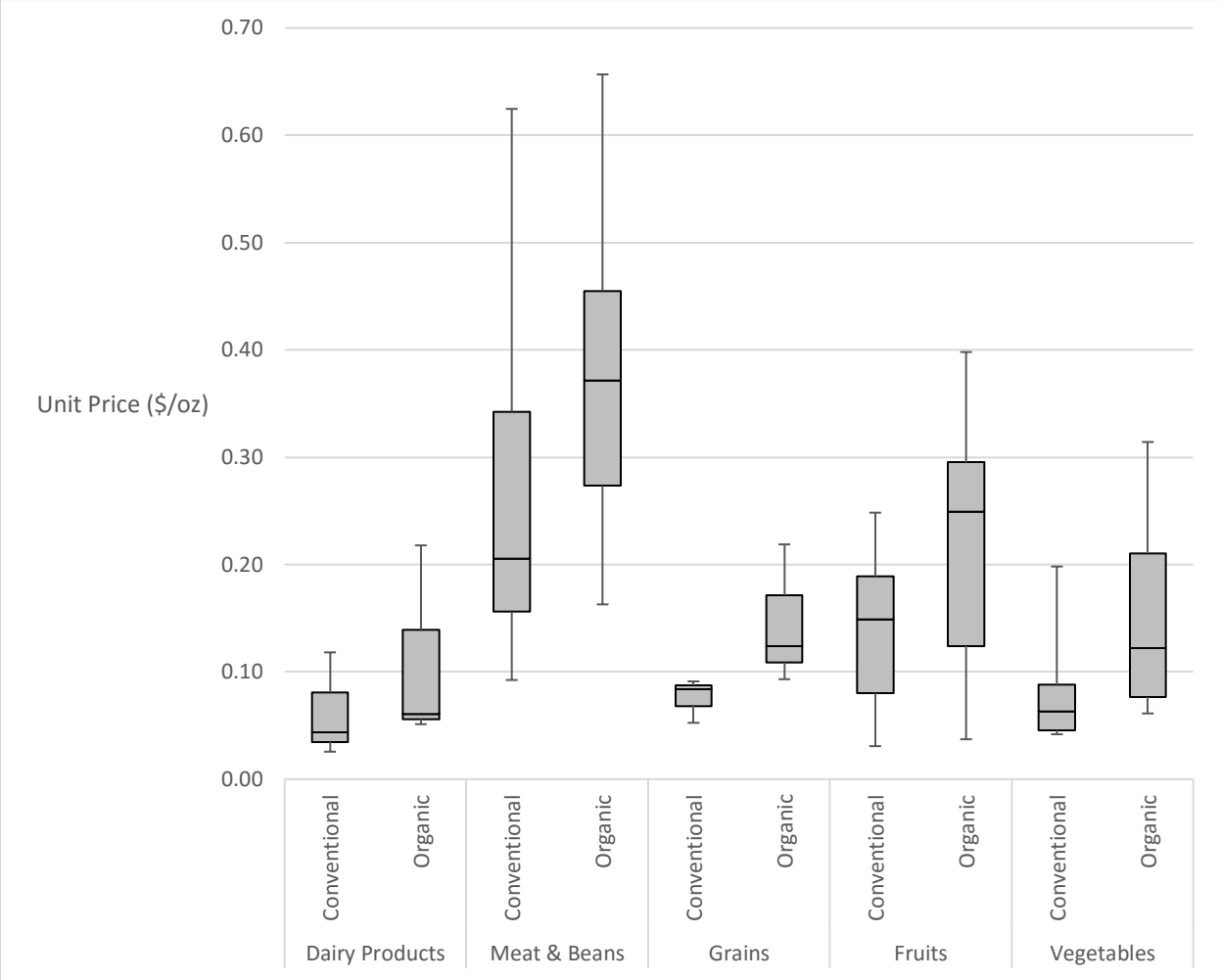

Table 1. 2015 Dietary Guidelines for Americans (DGA) Healthy U.S.-Style Eating Pattern (2,000 kcal), original and adjusted based on low, moderate and high sustainability patterns

FOOD GROUP	DAILY AMOUNT			
	2015 DGA	Levels of Sustainability		
		Low	Moderate	High
Vegetables	**2.5 c-eq**			
Dark-green vegetables (c-eq/wk)	1.5	1.5	1.5	1.5
Red & orange vegetables (c-eq/wk)	5.5	5.5	5.5	5.5
Legumes (beans and peas) (c-eq/wk)	1.5	2.25 [2]	2.75 [3]	3.25 [4]
Starchy vegetables (c-eq/wk)	5	5	5	5
Other vegetables (c-eq/wk)	4	4	4	4
Fruits	**2 c-eq**			
Whole fruit (c-eq/day)	NS [1]	1 (50%)	1.5 (75%)	2 (100%)
Fruit juice (c-eq/day)	NS [1]	1 (50%)	0.5 (25%)	0 (0%)
Grains	**6 oz-eq**			
Whole grains (oz-eq/day)	≥ 3	3 (50%)	4.5 (75%)	6 (100%)
Refined grains (oz-eq/day)	≤ 3	3 (50%)	1.5 (25%)	0 (0%)
Dairy Products	**3 c-eq**			
Meat & Beans	**5.5 oz-eq**			
Seafood (oz-eq/wk)	8	4	4	4
Meats, poultry, eggs (oz-eq/wk)	26	12 (red meat)	9 (red meat)	6 (red meat)
		9 (poultry)	9 (poultry)	8 (poultry)
		3 (eggs)	3.5 (eggs)	2 (eggs)
Nuts, seeds, soy products (oz-eq/wk)	5	7.5	9	11
Oils	**27 g**			
Limit on Calories for Other Uses	**270 (14%)**			

[1] Not specified

[2] Low sustainability pattern level include 1½ cups per week of legumes as a vegetable subgroup, and an additional 3 oz-eq (¾ cups) per week of legumes as a protein food. The total amount is shown here as legumes in the vegetable group.

[3] Moderate sustainability pattern level include 1½ cups per week of legumes as a vegetable subgroup, and an additional 5 oz-eq (1¼ cups) per week of legumes as a protein food. The total amount is shown here as legumes in the vegetable group.

[4] Low sustainability pattern level include 1½ cups per week of legumes as a vegetable subgroup, and an additional 7.5 oz-eq (1¾ cups) per week of legumes as a protein food. The total amount is shown here as legumes in the vegetable group.

Table 2. Market basket availability of conventional and organic foods by store

Stores	Conventional		Organic	
	Foods	**Items**	**Foods**	**Items**
	Available:Listed		Available:Listed	
Total	**67:68**	**117:119**	**52:68**	**78:119**
Discount grocery store	56:68	83:119	21:68	24:119
Supermarket 1	65:68	104:119	50:68	72:119
Supermarket 2	62:68	104:119	27:68	34:119
Supercenter	63:68	100:119	29:68	38:119
Small independent grocery store	56:68	85:119	1:68	1:119

Table 3. Availability of 119-item store food list for 68 conventional and organic foods in a discount grocery store, supermarkets (1 and 2), a supercenter and small independent grocery store

Foods	TOTAL		Discount Grocery Store		Supermarket 1		Supermarket 2		Supercenter		Small Independent Grocery Store	
	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic
Dairy Products	**12:12**	**5:12**	**9:12**	**2:12**	**10:12**	**4:12**	**12:12**	**4:12**	**12:12**	**3:12**	**10:12**	**0:12**
Milk	**4:4**	**2:4**	**1:4**	**2:4**	**3:4**	**2:4**	**4:4**	**2:4**	**4:4**	**2:4**	**4:4**	**0:4**
Low-fat & Nonfat	3:3	1:3	1:3	1:3	2:3	1:3	3:3	1:3	3:3	1:3	3:3	0:3
Soy Milk	1:1	1:1	0:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Cheese	**3:3**	**1:3**	**3:3**	**0:3**	**3:3**	**0:3**	**3:3**	**1:3**	**3:3**	**0:3**	**3:3**	**0:3**
Cheddar	1:1	1:1	1:1	0:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1
Mozzarella	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Swiss	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Yogurt & Cottage Cheese	**3:3**	**2:3**	**3:3**	**0:3**	**3:3**	**2:3**	**3:3**	**1:3**	**3:3**	**1:3**	**3:3**	**0:3**
Yogurt	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1
Greek Yogurt	1:1	1:1	1:1	0:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Cottage Cheese	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Other Dairy	**2:2**	**0:2**	**2:2**	**0:2**	**1:2**	**0:2**	**2:2**	**0:2**	**2:2**	**0:2**	**0:2**	**0:2**
Sour cream	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	0:1	0:1
Half & Half	1:1	0:1	1:1	0:1	0:1	0:1	1:1	0:1	1:1	0:1	0:1	0:1
Meat & Beans	**50:51**	**32:51**	**29:51**	**8:51**	**43:51**	**29:51**	**40:51**	**8:51**	**37:51**	**10:51**	**29:51**	**1:51**
Seafood	**11:11**	**9:11**	**3:11**	**4:11**	**10:11**	**6:11**	**10:11**	**4:11**	**7:11**	**5:11**	**5:11**	**0:11**
Salmon	3:3	2:3	1:3	1:3	3:3	2:3	3:3	1:3	3:3	2:3	2:3	0:3
Tuna	3:3	2:3	1:3	2:3	2:3	1:3	3:3	2:3	1:3	2:3	1:3	0:3
Haddock	2:2	2:2	0:2	1:2	2:2	0:2	1:2	1:2	1:2	1:2	0:2	0:2
Shrimp	3:3	3:3	1:3	0:3	3:3	3:3	3:3	0:3	2:3	0:3	2:3	0:3
Red Meat	**12:12**	**5:12**	**7:12**	**1:12**	**10:12**	**5:12**	**10:12**	**0:12**	**9:12**	**1:12**	**7:12**	**0:12**
Ground Beef	2:2	1:2	2:2	1:2	1:2	1:2	1:2	0:2	1:2	1:2	1:2	0:2
Eye of Round Roast	1:1	0:1	0:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Top Round/ Strip Steak	2:2	1:2	1:2	0:2	1:2	1:2	2:2	0:2	1:2	0:2	1:2	0:2
Stew Beef	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1
Ground Pork	1:1	1:1	0:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	0:1	0:1
Pork Roast	2:2	0:2	0:2	0:2	2:2	0:2	2:2	0:2	1:2	0:2	1:2	0:2
Pork Tenderloin	1:1	1:1	1:1	0:1	1:1	1:1	0:1	0:1	1:1	0:1	0:1	0:1
Pork Chops	2:2	0:2	2:2	0:2	2:2	0:2	2:2	0:2	2:2	0:2	2:2	0:2
Poultry	**20:20**	**11:20**	**14:20**	**2:20**	**16:20**	**11:20**	**15:20**	**2:20**	**15:20**	**2:20**	**12:20**	**0:20**
Ground Chicken	1:1	1:1	0:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	0:1	0:1
Chicken Breasts	5:5	4:5	4:5	1:5	5:5	4:5	4:5	1:5	4:5	1:5	4:5	0:5
Chicken Thighs	3:3	2:3	3:3	0:3	2:3	2:3	2:3	0:3	2:3	1:3	2:3	0:3
Half Chicken	1:1	0:1	0:1	0:1	0:1	0:1	0:1	0:1	0:1	0:1	1:1	0:1
Whole Chicken	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1	1:1	0:1
Ground Turkey	2:2	1:2	2:2	0:2	1:2	1:2	1:2	0:2	2:2	0:2	1:2	0:2
Turkey Breasts	5:5	2:5	3:5	0:5	4:5	2:5	4:5	0:5	4:5	0:5	2:5	0:5
Turkey Thighs	1:1	0:1	0:1	0:1	1:1	0:1	1:1	0:1	0:1	0:1	0:1	0:1
Whole Turkey	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1

Foods	TOTAL		Discount Grocery Store		Supermarket 1		Supermarket 2		Supercenter		Small Independent Grocery Store	
	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic
Eggs	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**1:1**	**0:1**
Eggs	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Nuts, Seeds & Soy Products	**6:7**	**6:7**	**4:7**	**0:7**	**6:7**	**6:7**	**4:7**	**1:7**	**5:7**	**1:7**	**4:7**	**1:7**
Peanuts	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Almonds	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1
Pecans	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1
Pumpkin Seeds	1:1	1:1	0:1	0:1	1:1	1:1	0:1	0:1	0:1	0:1	0:1	0:1
Sunflower Seeds	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1
Tofu	1:1	1:1	0:1	0:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1
Tempeh	0:1	1:1	0:1	0:1	0:1	1:1	0:1	0:1	0:1	0:1	0:1	0:1
Grains	**7:7**	**6:7**	**7:7**	**2:7**	**7:7**	**6:7**	**6:7**	**4:7**	**6:7**	**3:7**	**6:7**	**0:7**
Whole Wheat/ Grain Bread	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Whole Wheat/ Grain Tortilla/Wrap	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Brown Rice	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Whole Wheat/ Grain Pasta	1:1	1:1	1:1	0:1	1:1	1:1	1:1	1:1	1:1	0:1	1:1	0:1
Barley	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1
Farro	1:1	1:1	1:1	0:1	1:1	1:1	0:1	0:1	0:1	0:1	0:1	0:1
Oats	1:1	1:1	1:1	0:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Fruits	**16:16**	**13:16**	**15:16**	**5:16**	**14:16**	**13:16**	**15:16**	**6:16**	**16:16**	**7:16**	**10:16**	**0:16**
Apples	3:3	3:3	3:3	2:3	2:3	3:3	3:3	2:3	3:3	2:3	2:3	0:3
Grapes	3:3	3:3	3:3	0:3	3:3	3:3	3:3	2:3	3:3	3:3	3:3	0:3
Strawberries	2:2	2:2	3:3	2:2	2:3	2:2	2:3	1:2	3:3	1:2	2:3	0:2
Watermelon	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	0:1	0:1
Peaches	4:4	2:4	3:4	0:4	3:4	2:4	3:4	0:4	4:4	0:4	2:4	0:4
Blueberries	3:3	3:3	3:3	1:3	3:3	3:3	3:3	1:3	3:3	1:3	1:3	0:3
Vegetables	**30:31**	**21:31**	**21:31**	**6:31**	**28:31**	**19:31**	**29:31**	**12:31**	**27:31**	**15:31**	**28:31**	**0:31**
Dark-green	**3:3**	**3:3**	**3:3**	**1:3**	**3:3**	**3:3**	**3:3**	**2:3**	**3:3**	**3:3**	**3:3**	**0:3**
Romaine Lettuce	1:1	1:1	1:1	0:1	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1
Broccoli	2:2	2:2	2:2	1:2	2:2	2:2	2:2	1:2	2:2	2:2	2:2	0:2
Red & orange	**9:9**	**6:9**	**6:9**	**2:9**	**8:9**	**4:9**	**8:9**	**4:9**	**8:9**	**4:9**	**7:9**	**0:9**
Sweet Potatoes	2:2	2:2	1:2	0:2	2:2	1:2	1:2	0:2	1:2	1:2	1:2	0:2
Tomatoes	4:4	3:4	3:4	2:4	4:4	2:4	4:4	3:4	4:4	2:4	3:4	0:4
Carrots	3:3	1:3	2:3	0:3	2:3	1:3	3:3	1:3	3:3	1:3	3:3	0:3
Legumes (Beans & Peas)	**7:7**	**3:7**	**2:7**	**2:7**	**7:7**	**3:7**	**7:7**	**1:7**	**5:7**	**1:7**	**7:7**	**0:7**
Pinto Beans	2:2	1:2	1:2	1:2	2:2	1:2	2:2	1:2	2:2	1:2	2:2	0:2
Lima Beans	3:3	0:3	1:3	0:3	3:3	0:3	3:3	0:3	2:3	0:3	3:3	0:3
Lentils	2:2	2:2	0:2	1:2	2:2	2:2	2:2	0:2	1:2	0:2	2:2	0:2

Foods	TOTAL		Discount Grocery Store		Supermarket 1		Supermarket 2		Supercenter		Small Independent Grocery Store	
	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic
Starchy	**7:8**	**5:8**	**7:8**	**1:8**	**6:8**	**5:8**	**7:8**	**5:8**	**7:8**	**5:8**	**7:8**	**0:8**
White Potatoes	2:3	1:3	2:3	0:3	2:3	1:3	2:3	1:3	2:3	1:3	2:3	0:3
Corn	3:3	2:3	3:3	0:3	2:3	2:3	3:3	2:3	3:3	2:3	3:3	0:3
Green Peas	2:2	2:2	2:2	1:2	2:2	2:2	2:2	2:2	2:2	2:2	2:2	0:2
Other	**4:4**	**4:4**	**3:4**	**0:4**	**4:4**	**4:4**	**4:4**	**0:4**	**4:4**	**2:4**	**4:4**	**0:4**
Cooking (Yellow) Onion	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1
Head (Iceberg) Lettuce	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1	1:1	1:1	1:1	0:1
Cabbage	2:2	2:2	1:2	0:2	2:2	2:2	2:2	0:2	2:2	0:2	2:2	0:2
Fats, Oils & Sweets	**2:2**	**1:2**	**2:2**	**1:2**	**2:2**	**1:2**	**2:2**	**0:2**	**2:2**	**0:2**	**2:2**	**0:2**
Vegetable Oil	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1	1:1	0:1
Canola Oil	1:1	1:1	1:1	1:1	1:1	1:1	1:1	0:1	1:1	0:1	1:1	0:1

Table 4. Average unit price (dollars per ounce) of 119-item store food list for 68 conventional and organic foods in a discount grocery store, supermarkets (1 and 2), a supercenter and small independent grocery store

Foods	TOTAL[1]		Discount grocery store		Supermarket 1		Supermarket 2		Supercenter		Small independent grocery store	
	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic
	$/oz		*$/oz*		*$/oz*		*$/oz*		*$/oz*		*$/oz*	
Dairy Products												
Milk												
Low-fat & Nonfat	$0.13	$0.06	$0.02	$0.05	$0.17	$0.06	$0.16	$0.06	$0.14	$0.06	$0.18	N/A
Soy Milk	$0.05	$0.05	N/A	$0.03	$0.06	$0.04	$0.04	$0.06	$0.04	$0.05	$0.07	N/A
Cheese												
Cheddar	$0.31	$0.62	$0.20	N/A	$0.34	N/A	$0.37	$0.62	$0.31	N/A	$0.35	N/A
Mozzarella	$0.25	N/A	$0.24	N/A	$0.22	N/A	$0.20	N/A	$0.26	N/A	$0.33	N/A
Swiss	$0.29	N/A	$0.22	N/A	$0.31	N/A	$0.31	N/A	$0.26	N/A	$0.37	N/A
Yogurt & Cottage												
Yogurt	$0.07	$0.14	$0.06	N/A	$0.08	$0.14	$0.08	N/A	$0.07	N/A	$0.08	N/A
Greek Yogurt	$0.16	$0.18	$0.11	N/A	$0.13	$0.20	$0.14	$0.13	$0.12	$0.22	$0.28	N/A
Cottage Cheese	$0.13	N/A	$0.10	N/A	$0.12	N/A	$0.12	N/A	$0.11	N/A	$0.18	N/A
Other Dairy												
Sour cream	$0.09	N/A	$0.07	N/A	$0.09	N/A	$0.09	N/A	$0.10	N/A	N/A	N/A
Half & Half	$0.07	N/A	$0.06	N/A	N/A	N/A	$0.08	N/A	$0.07	N/A	N/A	N/A
Meat & Beans												
Seafood												
Salmon	$0.43	$0.69	$0.18	$0.43	$0.49	$0.94	$0.49	$0.79	$0.49	$0.61	$0.51	N/A
Tuna	$0.25	$0.59	$0.13	$0.31	$0.30	$0.69	$0.47	$0.67	$0.16	$0.70	$0.17	N/A
Haddock	$0.52	$0.40	N/A	$0.31	$0.60	N/A	$0.34	$0.44	$0.62	$0.46	N/A	N/A
Shrimp	$0.83	$0.96	$0.47	N/A	$0.91	$0.96	$0.88	N/A	$0.59	N/A	$1.28	N/A
Red Meat												
Ground Beef	$0.31	$0.42	$0.23	$0.44	$0.41	$0.44	$0.40	N/A	$0.34	$0.37	$0.16	N/A
Eye of Round Roast	$0.31	N/A	N/A	N/A	$0.31	N/A	$0.33	N/A	$0.30	N/A	$0.29	N/A
Top Round/ Strip Steak	$0.41	$0.90	$0.31	N/A	$0.41	$0.90	$0.57	N/A	$0.39	N/A	$0.38	N/A
Stew Beef	$0.33	$0.58	$0.27	N/A	$0.39	$0.58	$0.35	N/A	$0.32	N/A	$0.34	N/A
Ground Pork	$0.27	$0.37	N/A	N/A	$0.31	$0.37	$0.31	N/A	$0.19	N/A	N/A	N/A
Pork Roast	$0.16	N/A	N/A	N/A	$0.17	N/A	$0.16	N/A	$0.13	N/A	$0.17	N/A
Pork Tenderloin	$0.23	$1.00	$0.21	N/A	$0.26	$1.00	N/A	N/A	$0.22	N/A	N/A	N/A
Pork Chops	$0.22	N/A	$0.18	N/A	$0.36	N/A	$0.20	N/A	$0.19	N/A	$0.20	N/A
Poultry												
Ground Chicken	$0.23	$0.41	N/A	N/A	$0.28	$0.41	$0.23	N/A	$0.19	N/A	N/A	N/A
Chicken Breasts	$0.23	$0.42	$0.13	$0.27	$0.25	$0.53	$0.28	$0.49	$0.24	$0.37	$0.26	N/A
Chicken Thighs	$0.13	$0.28	$0.11	N/A	$0.19	$0.29	$0.15	N/A	$0.14	$0.27	$0.10	N/A
Half Chicken	$0.11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	$0.11	N/A
Whole Chicken	$0.07	$0.24	$0.06	$0.36	$0.06	$0.21	$0.08	$0.16	$0.07	N/A	$0.07	N/A
Ground Turkey	$0.24	$0.37	$0.15	N/A	$0.37	$0.37	$0.29	N/A	$0.18	N/A	$0.22	N/A
Turkey Breasts	$0.24	$0.53	$0.11	N/A	$0.28	$0.52	$0.28	N/A	$0.24	N/A	$0.31	N/A
Turkey Thighs	$0.18	N/A	N/A	N/A	$0.17	N/A	$0.18	N/A	N/A	N/A	N/A	N/A
Whole Turkey	$0.09	N/A	$0.08	N/A	$0.11	N/A	$0.13	N/A	$0.06	N/A	$0.06	N/A

[1] Total average unit price of the discount grocery store, supermarket 1, supermarket 2, supercent and indeprendent grocery store combined

Foods	TOTAL[1]		Discount grocery store		Supermarket 1		Supermarket 2		Supercenter		Small independent grocery store	
	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic
	Price/oz ($)		*Price/oz ($)*		*Price/oz ($)*		*Price/oz ($)*		*Price/oz ($)*		*Price/oz ($)*	
Eggs												
Eggs	$0.08	$0.21	$0.05	$0.18	$0.05	$0.20	$0.08	$0.20	$0.09	$0.25	$0.12	N/A
Nuts, Seeds & Soy												
Peanuts	$0.14	N/A	$0.12	N/A	$0.12	N/A	$0.17	N/A	$0.13	N/A	$0.15	N/A
Almonds	$0.55	$0.73	$0.46	N/A	$0.56	$0.73	$0.53	N/A	$0.50	N/A	$0.70	N/A
Pecans	$0.68	$1.17	$0.55	N/A	$0.72	$1.17	$0.75	N/A	$0.76	N/A	$0.62	N/A
Pumpkin Seeds	$0.41	$0.52	N/A	N/A	$0.41	$0.52	N/A	N/A	N/A	N/A	N/A	N/A
Sunflower Seeds	$0.25	$0.46	$0.19	N/A	$0.17	$0.46	$0.32	N/A	$0.22	N/A	$0.34	N/A
Tofu	$0.14	$0.18	N/A	N/A	$0.16	$0.14	N/A	$0.23	$0.12	$0.16	N/A	$0.19
Tempeh	N/A	$0.34	N/A	N/A	N/A	$0.34	N/A	N/A	N/A	N/A	N/A	N/A
Grains												
Whole Wheat/ Grain Bread	$0.09	$0.19	$0.06	$0.14	$0.10	$0.21	$0.13	$0.19	$0.08	$0.22	$0.10	N/A
Whole Wheat/ Grain Tortilla/Wrap	$0.19	N/A	$0.09	N/A	$0.17	N/A	$0.27	N/A	$0.17	N/A	$0.24	N/A
Brown Rice	$0.09	$0.14	$0.11	$0.11	$0.13	$0.23	$0.07	$0.13	$0.05	$0.09	$0.10	N/A
Whole Wheat/ Grain Pasta	$0.08	$0.15	$0.07	N/A	$0.09	$0.12	$0.09	$0.17	$0.06	N/A	$0.09	N/A
Barley	$0.12	$0.19	$0.19	N/A	$0.07	$0.19	$0.07	N/A	$0.17	N/A	$0.08	N/A
Farro	$0.28	$0.36	$0.19	N/A	$0.37	$0.36	N/A	N/A	N/A	N/A	N/A	N/A
Oats	$0.10	$0.15	$0.10	N/A	$0.10	$0.16	$0.12	$0.18	$0.09	$0.12	$0.09	N/A
Fruits												
Apples	$0.29	$0.17	$0.86	$0.07	$0.10	$0.42	$0.28	$0.10	$0.12	$0.08	$0.08	N/A
Grapes	$0.13	$0.28	$0.11	N/A	$0.14	$0.36	$0.14	$0.20	$0.14	$0.27	$0.14	N/A
Strawberries	$0.20	$0.30	$0.17	$0.25	$0.21	$0.37	$0.21	$0.33	$0.15	$0.25	$0.25	N/A
Watermelon	$0.04	N/A	$0.05	N/A	$0.02	N/A	$0.04	N/A	$0.04	N/A	N/A	N/A
Peaches	$0.32	$0.22	$0.89	N/A	$0.17	$0.22	$0.13	N/A	$0.27	N/A	$0.14	N/A
Blueberries	$0.48	$0.39	$0.39	$0.30	$0.46	$0.57	$0.67	$0.37	$0.48	$0.31	$0.38	N/A
Vegetables												
Dark-green												
Romaine Lettuce	$0.09	$0.23	$0.13	N/A	$0.08	$0.09	$0.09	$0.28	$0.09	$0.31	$0.07	N/A
Broccoli	$0.10	$0.19	$0.09	$0.14	$0.08	$0.19	$0.12	$0.17	$0.11	$0.24	$0.12	N/A
Red & orange												
Sweet Potatoes	$0.07	$0.14	$0.07	N/A	$0.09	$0.08	$0.07	N/A	$0.07	$0.19	$0.04	N/A
Tomatoes	$0.18	$0.13	$0.06	$0.12	$0.29	$0.15	$0.18	$0.12	$0.28	$0.15	$0.07	N/A
Carrots	$0.06	$0.07	$0.05	N/A	$0.06	$0.08	$0.08	$0.08	$0.06	$0.06	$0.06	N/A
Legumes (Beans &												
Pinto Beans	$0.07	$0.07	$0.04	$0.05	$0.08	$0.07	$0.07	$0.08	$0.07	$0.06	$0.10	N/A
Lima Beans	$0.10	N/A	$0.05	N/A	$0.09	N/A	$0.12	N/A	$0.09	N/A	$0.14	N/A
Lentils	$0.09	$0.15	N/A	$0.12	$0.08	$0.18	$0.09	N/A	$0.10	N/A	$0.09	N/A

[1] Total average unit price of the discount grocery store, supermarket 1, supermarket 2, supercent and indeprendent grocery store combined

Foods	TOTAL[1]		Discount grocery store		Supermarket 1		Supermarket 2		Supercenter		Small independent grocery store	
	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic	Conventional	Organic
	Price/oz ($)		*Price/oz ($)*		*Price/oz ($)*		*Price/oz ($)*		*Price/oz ($)*		*Price/oz ($)*	
Starchy												
White Potatoes	$0.05	$0.17	$0.03	N/A	$0.06	$0.37	$0.07	$0.07	$0.05	$0.07	$0.05	N/A
Corn	$0.07	$0.13	$0.08	N/A	$0.05	$0.13	$0.12	$0.14	$0.06	$0.13	$0.06	N/A
Green Peas	$0.07	$0.13	$0.05	$0.12	$0.05	$0.13	$0.06	$0.14	$0.07	$0.13	$0.14	N/A
Other												
Cooking (Yellow) Onion	$0.05	$0.08	$0.03	N/A	$0.06	$0.08	$0.05	N/A	$0.06	$0.08	$0.07	N/A
Head (Iceberg) Lettuce	$0.08	$0.17	$0.07	N/A	$0.07	$0.17	$0.09	N/A	$0.07	$0.16	N/A	N/A
Cabbage	$0.06	$0.13	$0.05	N/A	$0.06	$0.13	$0.07	N/A	$0.05	N/A	$0.07	N/A
Fats, Oils & Sweets												
Vegetable Oil	$0.06	N/A	$0.04	N/A	$0.07	N/A	$0.08	N/A	$0.05	N/A	$0.08	N/A
Canola Oil	$0.06	$0.34	$0.04	$0.24	$0.07	$0.44	$0.09	N/A	$0.05	N/A	N/A	N/A

[1] Total average unit price of the discount grocery store, supermarket 1, supermarket 2, supercent and indeprendent grocery store combined

Table 5. Organic food group and subgroup price premiums (discounts)

Foods	ORGANIC
	Premium (Discount)(%)
TOTAL	**70%**
Dairy Products	**64%**
Milk	45%
Cheese	98%
Yogurt & Cottage Cheese	65%
Other Dairy	--
Meat & Beans	**92%**
Seafood	43%
Red Meat	124%
Poultry	121%
Eggs	161%
Nuts, Seeds & Soy Products	53%
Grains	**66%**
Fruits	**62%**
Vegetables	**93%**
Dark-green	91%
Red & orange	52%
Legumes (Beans & Peas)	80%
Starchy	146%
Other	100%
Fats, Oils & Sweets	**42%**

Table 6. Farmers' market fruit and vegetable price premiums (discounts)

Produce		Farmers' Market
		Premium (Discount) (%)
TOTAL	**n=21(%)**	**-21%**
Fruits	**n=3(14.3%)**	**-22%**
Vegetables	**n=18(85.7%)**	**-20%**
Dark-green	n=2(9.5%)	-9%
Red & orange	n=5(23.8%)	-16%
Legumes (Beans & Peas)	n=0(0.0%)	N/A
Starchy	n=2(9.5%)	-4%
Other	n=9(42.9%)	-20%

Table 7. Average monthly cost of (a) USDA TFP, (b) sustainable healthy U.S.-style eating pattern, and (c) sustainable TFP after organic price premiums and farmers' market produce price discounts were added to the sustainable healthy U.S.-style eating pattern for reference family (male and female adult ages 20-50 and two children ages 6-8 and 9-11)

		a	*b*		*c*	
		Original TFP	**Sustainable Healthy U.S.-style Eating Pattern**		**+ Organic & Farmers' Market Premium / Discount**	
		Total	**Total**	**Cost I/D(%) [1]**	**Total**	**Cost I/D(%) [1]**
Child, 6-8y	Low	--	106.12	+10%	174.51	+81%
	Moderate	--	103.40	+7%	169.01	+75%
	High	--	97.59	+1%	159.42	+65%
	TFP	96.62				
Child, 9-11y	Low	--	131.33	+15%	212.86	+86%
	Moderate	--	133.50	+17%	215.02	+88%
	High	--	125.26	+9%	201.24	+76%
	TFP	114.43				
Total Child Average	Low	--	118.73	+13%	193.69	+84%
	Moderate	--	118.45	+12%	192.02	+82%
	High	--	111.43	+6%	180.33	+71%
	TFP	105.53				
Male, 20-50y	Low	--	171.65	+31%	278.53	+113%
	Moderate	--	169.46	+30%	275.15	+111%
	High	--	163.98	+25%	265.66	+103%
	TFP	130.71				
Female, 20-50y	Low	--	145.53	+23%	236.06	+99%
	Moderate	--	142.69	+21%	230.95	+95%
	High	--	137.11	+16%	221.21	+87%
	TFP	118.34				
Total Average	Low	--	138.66	+21%	225.49	+96%
	Moderate	--	137.26	+19%	222.53	+93%
	High	--	130.99	+14%	211.88	+84%
	TFP	115.03				

[1] Cost I/D(%) = Monthly TFP cost increase/decrease(%)

Table 8. Average monthly cost of sustainable TFP by food group for reference family (male and female adult ages 20-50 and two children ages 6-8 and 9-11)

		Dairy Products		Meat & Beans		Grains		Fruits		Vegetables		Fats, Oils & Sweets		Total	
		$/Mo.	Cost I/D(%)[1]	$/Mo.	Cost I/D(%)[1]	$/Mo.	Cost I/D(%)[1]	$/Mo.	Cost I/D(%)[1]	$/Mo.	Cost I/D(%)[1]	$/Mo.	Cost I/D(%)[1]	$/Mo.	Cost I/D(%)[1]
Child, 6-8y	Low	29.54	+164%	63.57	+106%	26.06	+47%	23.28	+53%	30.08	+57%	1.99	-17%	174.51	+81%
	Moderate	29.47	+163%	55.05	+78%	27.32	+54%	22.00	+45%	33.18	+73%	1.99	-17%	169.01	+75%
	High	29.11	+160%	49.27	+60%	27.97	+57%	19.81	+31%	31.27	+63%	1.99	-17%	159.42	+65%
	TFP	11.20		30.88		17.77		15.18		19.19		2.40		96.62	
Child, 9-11y	Low	31.03	+91%	66.82	+214%	33.47	+99%	31.17	+58%	47.86	+29%	2.51	-24%	212.86	+86%
	Moderate	31.95	+97%	59.33	+179%	37.20	+121%	31.27	+59%	52.42	+41%	2.85	-14%	215.02	+88%
	High	33.18	+104%	51.67	+143%	35.09	+108%	29.01	+47%	49.78	+34%	2.51	-24%	201.24	+76%
	TFP	16.23		21.28		16.85		19.70		37.07		3.30		114.43	
Total Child Average	Low	30.28	+121%	65.19	+150%	29.76	+72%	27.22	+56%	38.97	+39%	2.25	-21%	193.69	+84%
	Moderate	30.71	+124%	57.19	+119%	32.26	+86%	26.64	+53%	42.80	+52%	2.42	-15%	192.02	+82%
	High	31.14	+127%	50.47	+94%	31.53	+82%	24.41	+40%	40.52	+44%	2.25	-21%	180.33	+71%
	TFP	13.72		26.08		17.31		17.44		28.13		2.85		105.53	
Male, 20-50y	Low	35.59	+110%	83.67	+160%	56.56	+184%	38.43	+51%	59.75	+131%	4.53	-56%	278.53	+113%
	Moderate	35.11	+107%	79.33	+147%	61.32	+208%	35.66	+40%	58.64	+127%	5.08	-51%	275.15	+111%
	High	35.49	+109%	71.64	+123%	59.08	+197%	33.08	+30%	61.62	+139%	4.76	-54%	265.66	+103%
	TFP	16.97		32.14		19.89		25.53		25.82		10.36		130.71	
Female, 20-50y	Low	35.88	+99%	73.36	+150%	39.54	+101%	34.23	+66%	49.95	+93%	3.10	-36%	236.06	+99%
	Moderate	35.88	+99%	66.18	+126%	43.01	+119%	32.27	+57%	50.50	+95%	3.10	-36%	230.95	+95%
	High	35.88	+99%	59.48	+103%	39.51	+101%	30.33	+47%	52.91	+105%	3.10	-36%	221.21	+87%
	TFP	18.00		29.34		19.68		20.60		25.86		4.86		118.34	
Total Average	Low	33.01	+112%	71.86	+153%	38.91	+110%	31.78	+57%	46.91	+74%	3.03	-42%	225.49	+96%
	Moderate	33.10	+112%	64.97	+129%	42.21	+128%	30.30	+50%	48.69	+80%	3.26	-38%	222.53	+93%
	High	33.42	+114%	58.01	+104%	40.41	+118%	28.06	+39%	48.89	+81%	3.09	-41%	211.88	+84%
	TFP	15.60		28.41		18.55		20.25		26.99		5.23		115.03	

[1] Cost I/D(%) = Monthly TFP cost increase/decrease(%)

Table 9. Sustainable TFP macronutrient and micronutrient information for reference family (male and female adult ages 20-50 and two children ages 6-8 and 9-11)

		Daily Calories	Macronutrients											
			Fat		Saturated fat		Linoleic acid		Linolenic acid		Carbohydrates		Protein	
			g	% of kcal	g	% of kcal	% of kcal		% of kcal		g	% of kcal	g	% of kcal
Child, 6-8y	Low	1693	53	28.3%	18	9.7%	5.7%		0.58%		226	53.4%	84	19.8%
	Moderate	1677	55	29.3%	18	9.9%	6.2%		0.60%		224	53.4%	81	19.3%
	High	1688	55	29.4%	18	9.7%	6.6%		0.61%		229	54.3%	78	18.5%
	TFP	1672	62	33.3%	17	9.2%	8.0%		0.71%		217	51.8%	72	17.3%
	Recommended	1680	25% to 35%		0% to 10%		5% to 10%		0.6% to 1.2%		45% to 65%		10% to 30%	
Child, 9-11y	Low	2095	64	27.3%	21	9.0%	5.8%		0.59%		293	56.0%	98	18.6%
	Moderate	2095	66	28.3%	22	9.3%	6.2%		0.61%		292	55.8%	96	18.3%
	High	2100	68	29.3%	22	9.6%	6.6%		0.64%		293	55.7%	92	17.6%
	TFP	2090	78	33.6%	21	9.1%	8.5%		0.83%		274	52.4%	89	17.0%
	Recommended	2100	25% to 35%		0% to 10%		5% to 10%		0.6% to 1.2%		45% to 65%		10% to 30%	
Total Child Average	Low	1894	59	27.8%	20	9.3%	5.9%		0.48%		260	54.8%	91	19.2%
	Moderate	1886	61	28.9%	20	9.5%	6.2%		0.48%		258	54.7%	89	18.8%
	High	1894	62	29.2%	20	9.5%	6.4%		0.48%		261	55.1%	85	18.0%
	TFP	1881	70	33.5%	19	9.1%	8.4%		0.72%		246	52.2%	81	17.1%
	Recommended	1890	25% to 35%		0% to 10%		5% to 10%		0.6% to 1.2%		45% to 65%		10% to 30%	
Male, 20-50y	Low	2868	88	27.6%	27	8.6%	6.2%		0.61%		410	57.2%	122	17.0%
	Moderate	2873	92	28.8%	28	8.8%	6.8%		0.64%		406	56.5%	122	17.0%
	High	2869	92	28.9%	27	8.6%	7.2%		0.65%		412	57.4%	117	16.3%
	TFP	2925	101	31.1%	27	8.3%	8.6%		0.94%		403	55.1%	116	15.8%
	Recommended	2940	25% to 35%		0% to 10%		5% to 10%		0.6% to 1.2%		45% to 65%		10% to 30%	
Female, 20-50y	Low	2256	72	28.8%	24	9.5%	6.0%		0.61%		309	54.7%	103	18.3%
	Moderate	2271	72	28.7%	24	9.4%	6.3%		0.62%		316	55.7%	101	17.9%
	High	2321	74	28.9%	24	9.2%	6.7%		0.64%		328	56.5%	99	17.1%
	TFP	2298	81	31.6%	22	8.5%	7.9%		0.73%		310	53.9%	97	17.0%
	Recommended	2310	25% to 35%		0% to 10%		5% to 10%		0.6% to 1.2%		45% to 65%		10% to 30%	
Total Average	Low	2228	69	28.0%	23	9.1%	6.1%		0.61%		310	55.6%	102	18.3%
	Moderate	2229	71	28.8%	23	9.3%	6.5%		0.61%		310	55.5%	100	17.9%
	High	2245	72	29.0%	23	9.1%	6.7%		0.60%		316	56.2%	97	17.2%
	TFP	2246	81	32.3%	22	8.7%	8.3%		0.80%		301	53.6%	94	16.6%
	Recommended	2258	25% to 35%		0% to 10%		5% to 10%		0.6% to 1.2%		45% to 65%		10% to 30%	

		Micronutrients											
		Calcium (mg)	Fiber (g)	Folate (mg)	Vitamin A (mg)	Vitamin C (mg)	Vitamin B_6 (mg)	Vitamin B_{12} (mg)	Potassium (mg)	Iron (mg)	Sodium (mg)	Cholesterol (mg)	Added sugars (g)
Child, 6-8y	Low	1264	19.9	563	1198	119	2.3	7.0	3402	15	1922	254	273
	Moderate	1251	22.9	509	1253	111	2.2	6.5	3389	14	1900	267	275
	High	1199	25.4	377	1111	93	2.0	5.6	3273	11	1857	225	264
	TFP	885	23.7	417	756	77	1.8	4.5	2894	12	2426	160	229
	Recommended	800	22.4	200	400	25	0.6	1.2	3800	10	1900	300	132
Child, 9-11y	Low	1404	28.1	704	1636	162	2.8	7.4	4303	19	2340	271	317
	Moderate	1413	31.5	654	1693	157	2.9	7.3	4305	18	2359	281	326
	High	1350	34.7	482	1562	134	2.6	5.8	4192	14	2362	224	330
	TFP	1365	34.1	534	1785	131	2.5	6.2	4336	15	2902	211	280
	Recommended	1300	28.0	300	600	45	1.0	1.8	4500	8	2200	300	267
Total Child Average	Low	1334	18.7	634	1417	141	2.6	7.2	3853	17	2131	263	295
	Moderate	1332	21.3	582	1473	134	2.6	6.9	3847	16	2130	274	301
	High	1275	23.5	430	1337	114	2.3	5.7	3733	13	2110	225	297
	TFP	1125	21.7	476	1271	104	2.2	5.4	3615	14	2664	186	255
	Recommended	1050	20.2	250	500	35	0.8	1.5	4150	9	2050	300	200
Male, 20-50y	Low	1577	38.6	1124	1879	214	3.9	8.8	5101	29	3331	343	433
	Moderate	1549	43.9	974	1873	190	3.8	8.2	5073	27	3242	404	435
	High	1478	49.5	640	1790	169	3.5	6.2	5170	20	3070	282	407
	TFP	1365	41.2	837	1376	137	3.2	6.4	5042	21	3504	315	411
	Recommended	1000	39.2	400	900	90	1.3	2.4	4700	8	2300	300	426
Female, 20-50y	Low	1402	29.9	769	1674	173	3.1	7.5	4431	20	2687	317	360
	Moderate	1389	34.2	711	1669	158	3.1	7.1	4445	20	2601	301	360
	High	1362	39.0	543	1607	145	3.0	6.0	4534	16	2560	258	356
	TFP	1315	32.7	670	1524	105	3.1	7.2	4266	19	2808	223	305
	Recommended	1000	30.8	400	700	75	1.3	2.4	4700	18	2300	300	290
Total Average	Low	1412	29.1	790	1597	167	3.0	7.7	4309	21	2570	296	346
	Moderate	1401	33.1	712	1622	154	3.0	7.3	4303	20	2526	313	349
	High	1347	37.2	511	1518	135	2.8	5.9	4292	15	2462	247	339
	TFP	1233	32.9	615	1360	113	2.7	6.1	4135	17	2910	227	306
	Recommended	1025	30.1	325	650	59	1.1	2.0	4425	11	2175	300	279

APPENDIX

Appendix A: Food Store List

Foods	-Store Name-											
	Conventional	Organic	Conventional Information				Organic Information					
	Price (Quantity)		Brand	Type	Origin	Method	Brand	Type	Origin	Method	Label(s)	
Dairy Products												
Milk												
Low-fat (1%) & Non-fat (skim)												
liquid (1/2 gallon)			"Store" or Name of Manufacturer or Brand		Country of Origin						USDA Organic or other label	
dry												
canned (evaporated)												
Soy Milk (1/2 gallon)												
Cheese												
Cheddar												
Mozzarella (skim/part-skim)												
Swiss												
Yogurt & Cottage Cheese												
Yogurt												
Greek Yogurt												
Cottage Cheese (1% or skim)												
Other Dairy												
Sour cream (low-fat or fat-free)												
Half and Half (low-fat or fat-free)												
Meat & Beans												
Seafood												
Salmon												
fresh				i.e. Atlantic, Pink		Farm or Wild					USDA Organic, Marine Stewardship Council, Dolphin Safe, etc.	
frozen												
canned												
Tuna												
fresh				i.e. Yellowfin								
frozen												
canned												
Haddock												
fresh												
frozen												
Shrimp												
fresh				i.e. Black Tiger								
frozen												
canned												

Foods	-Store Name-										
	Conventional	Organic	Conventional Information				Organic Information				
	Price (Quantity)		Brand	Type	Origin	Method	Brand	Type	Origin	Method	Label(s)
Red Meat											
Beef, ground											
fresh						i.e. Grass-fed,					USDA Organic or other label
frozen											
Beef, eye of round roast											
Beef, top round or strip steak											
boneless						Pasture-raised, etc.					
bone-in											
Beef, stew											
Pork, ground											
Pork, roast											
boneless											
bone-in											
Pork, tenderloin											
Pork, chop											
boneless											
bone-in											
Poultry											
Chicken, ground											
Chicken, breast											
boneless						i.e. Cage Free, Free Range, etc.					
bone-in											
deli											
frozen											
canned											
Chicken, thigh											
boneless											
bone-in											
frozen											
Chicken, half											
Chicken, whole											

Foods	-Store Name-										
	Conventional	Organic	Conventional Information				Organic Information				
	Price (Quantity)		Brand	Type	Origin	Method	Brand	Type	Origin	Method	Label(s)
Turkey, ground											
fresh											
frozen											
Turkey, breast											
boneless											
bone-in											
deli											
frozen boneless											
frozen bone-in											
Turkey, thigh											
Turkey, whole											
Eggs											
Eggs, dozen (large)				White or Brown							
Nuts, Seeds & Soy Products											
Peanuts											
Almonds											
Pecans											
Pumpkin Seeds											
Sunflower Seeds											
Tofu											
Tempeh											
Grains											
Whole Wheat/Grain Bread											
Whole Wheat/Grain Tortilla/Wrap											
Brown Rice											
Whole Wheat/Grain Pasta											
Barley											
Farro											
Oats											

Foods	-Store Name-										
	Conventional	Organic	Conventional Information				Organic Information				
	Price (Quantity)		Brand	Type	Origin	Method	Brand	Type	Origin	Method	Label(s)
Fruits											
Apples											
fresh				"Store" or Local (local farm)							
dried											
juice											
Grapes											
fresh											
dried											
juice											
Strawberries											
fresh											
frozen											
Watermelon											
Peaches											
fresh											
canned											
frozen											
dried											
Blueberries											
fresh											
frozen											
dried											
Vegetables											
Dark-green											
Romaine Lettuce											
Broccoli											
fresh											
frozen											

Foods	-Store Name-											
	Conventional	Organic	Conventional Information				Organic Information					
	Price (Quantity)		Brand	Type	Origin	Method	Brand	Type	Origin	Method	Label(s)	
Red & orange												
Sweet Potatoes												
fresh												
frozen												
Tomatoes												
fresh												
canned												
juice												
dried												
Carrots												
fresh												
canned												
frozen												
Legumes (Beans & Peas)												
Pinto Beans												
dry												
canned												
Lima Beans												
dry												
canned												
frozen												
Lentils												
dry												
canned												
Starchy												
White Potatoes												
fresh												
canned												
frozen												
Corn (sweet)												
fresh												
canned												
frozen												
Green Peas												
canned												
frozen												

Foods	-Store Name-										
	Conventional	Organic	Conventional Information				Organic Information				
	Price (Quantity)		Brand	Type	Origin	Method	Brand	Type	Origin	Method	Label(s)
Other											
Cooking (Yellow) Onion											
Head Lettuce (Iceberg)											
Cabbage											
fresh											
fermented											
Fats, Oils & Sweets											
Vegetable Oil											
Canola Oil											

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